Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 1: Introduction

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 1: Introduction

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1 Introduction

1.1 Background

1.1.1 This Environmental Statement ("ES") has been prepared by AECOM Ltd ("AECOM") on behalf of Associated British Ports ("ABP") ("The Applicant"). It supports an application for development consent ("the Application") for the construction, operation and maintenance of a multi-user liquid bulk terminal, which would be located on the eastern side of the Port of Immingham ("the Port"), as well as associated development (collectively termed "the Project"). The Associated Development comprises the construction and operation of a green hydrogen facility for the production of green hydrogen from imported green ammonia on site by Air Products (BR) Ltd ("Air Products").

1.1.2 The Application has been submitted to the Planning Inspectorate (the "Inspectorate"), with the decision whether to grant a Development Consent Order ("DCO") pursuant to the Application being made by the Secretary of State for Transport (the "Secretary of State") pursuant to the *Planning Act 2008* (the "2008 Act") (Ref 1-1)). This ES presents the findings of the Environmental Impact Assessment ("EIA") undertaken for the Project.

1.1.3 A DCO would provide the principal authorisations and consents for the construction and operation (including maintenance) of the Project. The Site is located in North East Lincolnshire on the south bank of the Humber Estuary to the east of the Port. The land-side works fall within the administrative boundary of North East Lincolnshire Council ("NELC") on both land within the ownership of the Applicant and on areas of third party land. The marine-side works that extend seaward and fall beyond the local authority's boundary, would take place in the bed of the Humber Estuary, which is owned by the Crown Estate and over which the Applicant has the benefit of a long lease. The marine side parts of the Project are defined as a Nationally Significant Infrastructure Project ("NSIP") in accordance with the 2008 Act (refer to **Section 1.5** for details).

1.1.4 The Project is considered to be "EIA Development" as defined by the *Infrastructure Planning (Environmental Impact Assessment) Regulations 2017* (as amended in 2018) ("the EIA Regulations") (Ref 1-2)). This ES forms part of the DCO Application and presents the findings of the EIA undertaken for the Project in accordance with the EIA Regulations and the 2008 Act.

1.1.5 This chapter is supported by **Figure 1.1: Project Location [TR030008/APP/6.3]**, which illustrates the location of the Project and **Figure 1.2: Application Site Boundary [TR030008/APP/6.3]**, which illustrates the Order Limits.

1.2 The Applicant

1.2.1 ABP was established in 1981 following the privatisation of the British Transport Docks Board. It is the largest ports group in the United Kingdom ("UK"), owning and operating 21 ports and other transport-related businesses across England, Wales and Scotland. On the Humber, ABP owns and operates the Port and also the ports of Hull, Grimsby and Goole, which together constitute the largest ports complex in the UK.

1.2.2 The Port is the largest and busiest of ABP's four Humber ports and its statutory undertaking at Immingham (the 'statutory port estate') covers some 480 hectares ("ha"). The majority of the port estate falls within the administrative boundary of NELC, although the western part of the Port falls within the administrative boundary of North Lincolnshire Council ("NLC").

1.2.3 The Port comprises a number of discrete operational areas handling a diverse trade base including liquid fuels, solid fuels, ores, and Roll-on Roll-off ("Ro-Ro") freight being handled from existing in-river jetties. These include the Eastern and Western Jetties, the Immingham Oil Terminal, the Immingham Gas Terminal, Immingham Outer Harbour and the Humber International Terminal ("HIT").

1.2.4 The Project, if consented, would be located fully within an extended Port of Immingham Statutory Harbour Authority ("SHA") area where the Applicant is the SHA. In this capacity, the Applicant has a set of powers and duties which include management and regulation of the safety of navigation and marine operations in its SHA area.

1.2.5 Humber Estuary Services ("HES") is the SHA for the wider estuary and Competent Harbour Authority ("CHA") with respect to pilotage for the Humber Estuary and the ABP docks, and other port facilities therein. As the CHA, HES has the power to issue Pilotage Directions that prescribe which vessels require a Pilot or Pilot Exemption Certificate ("PEC") holder when navigating within the CHA area.

1.2.6 In addition to the Project, ABP is also proposing to construct a new Ro-Ro facility within the Port principally to service the embarkation and disembarkation of commercial cargo. The facility would include an element of passenger use when the demands of the Ro-Ro cargo operation allow. The proposed Ro-Ro facility is being promoted as an NSIP and is known as the Immingham Eastern Ro-Ro Terminal ("IERRT"). IERRT would comprise on the marine side the construction of a new Ro-Ro jetty with three berths, together with required dredging and on the landside, the provision of an area for unit load/vehicle storage and necessary new Terminal buildings. IERRT is also at the planning stage, but is entirely separate from this Project's proposals which are the subject of this ES. The cumulative effects of IERRT with IGET are however considered in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

1.3 Air Products (BR) Limited

1.3.1 Air Products is a world-leading industrial gases company that has been in operation for nearly 80 years, and more than 60 years in the UK and Ireland. It has over 1,000 UK and Ireland employees working across 35 production facilities, in addition to a number of hydrogen refuelling stations and hydrogen, nitrogen and oxygen plants. The company develops, engineers, builds, owns and operates some of the world's largest industrial gas projects.

1.3.2 In 2020, Air Products announced the signing of an agreement for a world-scale green hydrogen-based ammonia production facility powered by renewable energy. Their first green hydrogen-based ammonia production facility is sited in the Middle East and will produce green ammonia for export to global markets. The company plans to invest in a new green hydrogen production facility at Immingham, supported by a downstream distribution network. The plan is to import renewable (green) ammonia to convert into green hydrogen in particular to fuel heavy transport, such as Heavy Good Vehicles ("HGVs") and buses. Heavy transportation is one of the most challenging and polluting sectors to decarbonise and a priority for meeting net zero in the UK.

1.3.3 Air Products and ABP have entered into an agreement for the alteration of the existing harbour facility at the Port to provide a new terminal and associated landside development at the Port to facilitate the delivery of green ammonia and its storage and processing to produce green hydrogen.

1.4 The Project

Project Objectives

1.4.1 The objectives of the Project are as follows:

a. To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone.

b. To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH_3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist in the UK's transition towards net zero.

c. To deliver and operate new port infrastructure, and its first user's hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham.

d. To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community.

e. To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

1.4.2 The terminal would be operated by ABP as a common user terminal facility, providing port capacity for multiple customers. Air Products, as the first user of the new terminal, would import and export green ammonia (as a liquid bulk product) through the terminal. The Project would initially be used by Air Products as a conduit for the import of green ammonia, initially from the Middle East, but potentially also from Rotterdam, to be converted in a hydrogen production facility to create green hydrogen.

1.4.3 The green hydrogen production facility would directly support the aims of the UK Government's *British Energy Security Strategy* (Ref 1-3) with the production and delivery of low-carbon ("green") hydrogen, contributing to the decarbonisation of transport and the UK's journey to net zero, helping to improve Britain's energy security and supporting the Levelling Up agenda. The Project is anticipated to produce up to 300 Megawatts ("MW") of hydrogen per annum, the equivalent of up to 9.5 billion Megajoules ("MJ") per annum. Depending on market demand, it is estimated that this would meet up to 3% of UK Government's hydrogen production capacity target.

1.4.4 Other customers with other proposed developments or uses, that are compatible with green ammonia from a health and safety perspective, are expected to come forward in due course and these are likely to include customers in the carbon capture and storage sector. It is also anticipated that customers are likely to import or export a range of other different liquid bulk products.

1.5 Project Summary

1.5.1 The Project would comprise the following main elements. The work areas are shown on **Figure 2.3 [TR030008/APP/6.3]** and further details on the Project description are presented in **Chapter 2: The Project [TR030008/APP/6.2]**:

a. The NSIP, comprising:

   i. On the marine side, a terminal for liquid bulks: comprising:

      A. A jetty including a loading platform, associated dolphins, fenders and walkways, topside infrastructure but not limited to control rooms, marine loading arms, pipe-racks, pipelines and other infrastructure.

      B. A single berth, with a berthing pocket with a depth of up to 14.5m below chart datum.

   ii. Related landside infrastructure including, but not limited to, a jetty access ramp, a flood defence access ramp and works to raise the seawall locally under the jetty access ramp.

b. Associated Development on the landside, comprising:

   i. A corridor between the new jetty and Laporte Road which would support a private road (the 'jetty access road'), pipe-racks, pipelines to enable the ammonia import to the East Site, as well as security gates, a security building, a power distribution building and associated utilities.

   ii. 'East Site - Ammonia Storage' on which an ammonia storage tank and related plant including an ammonia tank flare stack would be constructed as well as additional buildings (including welfare building, power distribution building and a process instrumentation building), pipe-racks, pipelines, pipes, cable-racks, utilities and other infrastructure.

   iii. Construction of a culvert under Laporte Road for pipelines, pipes and cables and other conducting media linking the two parts of the East Site.

iv. 'East Site – Hydrogen Production Facility' on which up to three hydrogen production units and associated plant including flue gas stacks and flare stacks would be constructed together with additional buildings (including process control building, power distribution buildings, process instrumentation buildings, analyser shelters), pipe-racks, pipelines, pipes, utilities and other infrastructure.

v. Underground pipelines, pipes, cables and other conducting media between the East and West Sites, for the transfer of ammonia, hydrogen, nitrogen and utilities, with cathodic protection against saline corrosion.

vi. 'West Site' involving the construction of up to three hydrogen production units with associated flue gas stacks and flare stacks and up to four liquefier units; hydrogen storage tanks, hydrogen trailer filling stations, a hydrogen vent stack and associated process equipment; and hydrogen vehicle and trailer filling stations, hydrogen compressors and associated process equipment. Also additional buildings (including but not limited to control room and workshop building, security and visitor building, contractor building, warehouse, driver administration building, safe haven building, electrical substation and metering station, power distribution buildings, process instrumentation buildings, analyser buildings and additional temporary buildings during construction), process and utility plant including cooling towers and pumps, fire water tank, instrument air equipment, pipe-racks, pipelines, pipes, cable-racks, utilities and other infrastructure.

vii. Formation of temporary construction and laydown areas on Queens Road and off Laporte Road.

viii. Temporary removal of street furniture and modification of overhead cables on Kings Road associated with the transport of large construction components from the Port to the Site.

1.5.2 In addition to these elements 'Further associated development' and 'Ancillary Works' would be required. In broad terms Further Associated Development would be the undertaking, as required, of works such as site clearance, creation of additional construction compounds, utility works, landscaping works and street works on a Site wide basis. Ancillary Works constitute works that would not necessarily constitute development, such as vegetation removal, the installation of fencing and the demobilisation of construction works.

1.5.3 A detailed description of the Project is set out in **Chapter 2: The Project [TR030008/APP/6.2]**. The design of the Project is expected to continue to develop in the lead-in to the DCO Application examination and will be further refined up until the start of construction (subject to authorisation by the Secretary of State). Parameters have been established across aspects relating to the design and construction of the Project to manage design uncertainty and provide flexibility for deviation where needed. The parameters are defined in **Chapter 2: The Project [TR030008/APP/6.2].** The use of the parameter-based approach to incorporate design flexibility and how this is considered in EIA are described in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

1.5.4 Subject to the necessary consents being granted, there would be a phased approach to the construction of the Project. Construction could potentially start in early 2025, through to full completion of all phases over an indicative eleven-year period, including commissioning.

1.5.5 The Site encompasses an area of approximately 121.13ha of which approximately 13ha comprises the temporary construction areas.

1.5.6 The location of the Project is shown on **Figure 1.1: Project Location [TR030008/APP/6.3]**. The Site and its surroundings are described in **Chapter 2: The Project [TR030008/APP/6.2]**.

1.5.7 Environmental effects potentially arising from the Project have been studied systematically as part of the EIA process, with the results presented within this ES. The baseline for the assessment has been derived from surveys, measurements and studies in and around the Site. The approach to defining baseline conditions is explained further in **Chapter 5: EIA Approach [TR/030008/APP/6.2]** and in the methodology section of each technical assessment chapter of this ES (**Chapters 6 to 24**) **[TR030008/APP/6.2]**.

1.5.8 The EIA process has considered effects resulting from the construction, operation (including maintenance) and decommissioning periods (where appropriate) of the Project. Measures to avoid, reduce or mitigate any identified significant adverse effects on the environment have been considered and identified. Where reasonably practical, measures to enhance the environment have also been considered. The need for monitoring to track the delivery and success of mitigation measures is reported in this ES, where relevant, in the topic specific chapters of this ES (**Chapters 6 to 24**) **[TR030008/APP/6.2]**. The topic specific chapters also identifies any likely significant 'residual' effects, defined as effects remaining following the implementation of defined mitigation measures.

1.5.9 The potential cumulative effects of the Project with other relevant known proposed or consented schemes have been considered and these effects are assessed in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

1.6 The Development Consent Process

Nationally Significant Infrastructure Project

1.6.1 The NSIP would comprise the alteration of an existing harbour facility for the construction of a terminal consisting of a jetty with one berth capable of receiving and discharging tanker vessels transporting liquid bulks.

1.6.2 The terminal capacity is estimated at approximately 11 million tonnes per annum. The terminal would be capable of receiving and discharging liquid bulk vessels of a variety of sizes of between 100m to 250m in length with draughts of up to 12.8m. The number of vessel calls to the terminal is estimated to be approximately 292 per annum, which would include 12 vessel calls importing and exporting green ammonia to and from the hydrogen production facility. The vessels which make up the remaining 280 calls to the terminal are expected to

serve the future carbon capture and storage market and other liquid bulk energy product markets.

1.6.3 The typical vessels associated with the import and export of green ammonia would have a capacity when fully laden of approximately 55,000 tonnes. The typical vessels associated with the import and export of other liquid bulk energy products would have a capacity, when fully laden, of approximately 35,000 tonnes.

1.6.4 On this basis, the proposed harbour facility constitutes an NSIP as identified in s14(1)(j) and under Part 3, s24(2) and s24(3)(c) of the 2008 Act as it comprises:

i. "*The alteration of harbour facilities" (i.e. the existing Port of Immingham) – s24(2);*

ii. *"The harbour facilities are in England" – s24(2)(a); and*

iii. *"The effect of the alteration is expected to be to increase by at least the relevant quantity per year the quantity of material the embarkation or disembarkation of which the facilities are capable of handling" – s24(2)(b); where*

iv. *"The relevant quantity is… in the case of facilities for cargo ships, 5 million tonnes" – s24(3)(c)*.

1.6.5 The new jetty and single berth with a loading platform, topside infrastructure and relating landside infrastructure including a jetty access ramp, flood defence access ramp and other access infrastructure would comprise the NSIP (i.e. the principal development). Further details are set out in **Section 2.4** of **Chapter 2: The Project [TR030008/APP/6.2]**.

1.6.6 The infrastructure necessary to transfer the green ammonia from the jetty and development of the Site areas for the transfer and storage of the ammonia and the hydrogen production, storage and distribution would comprise "associated development" for the purpose of Section 115 of the 2008 Act. Further details are set out in **Section 2.4** of **Chapter 2: The Project [TR030008/APP/6.2]**.

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1.6.7 As an NSIP, the Applicant is required to seek a DCO to construct and operate (and maintain) the Project, under section 31 of the 2008 Act).

1.6.8 The Application for the Project has been submitted to the Inspectorate acting on behalf of the Secretary of State. Subject to the Application being accepted, the Inspectorate will then examine it and make a recommendation to the Secretary of State, who will then decide whether to grant a DCO. The acceptance, examination, recommendation and decision stages are subject to fixed timescales and the decision is therefore anticipated to fall in Quarter 1 2025.

1.6.9 The Order Limits include all works proposed as part of the Application, including those comprising the NSIP and the Associated Development (as defined by Section 115 of the 2008 Act and the accompanying *Guidance on Associated Development Applications for Major Infrastructure Projects* (Ref 1-4).

1.6.10 A DCO, if granted, has the effect of providing planning consent for a development, in addition to a range of other consents and authorisations where specified within the DCO as presented in the **Consents and Agreements Position Statement [TR030008/APP/7.4]**.

1.6.11 For the purposes of this Application, the principal development relates to **Work No. 1** in Schedule 1 of the **draft DCO [TR030008/APP/2.1]** and the Associated Development relates to **Work No. 2** to **10** of that same Schedule.

1.7 Environmental Impact Assessment

The Need for an Environmental Impact Assessment

1.7.1 The Project is subject to mandatory EIA procedures, as set out within paragraph 8(2) of Schedule 1 of the EIA Regulations as it comprises '*Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1,350 tonnes*'. As such, an EIA is required for the Project and this ES has been prepared in accordance with the EIA Regulations to accompany the Application.

1.7.2 The Applicant has formally notified the Secretary of State in writing under Regulation 8(1)(b) of the EIA Regulations that an ES would be prepared in respect of the Project. The Project is therefore 'EIA development' for the purposes of the EIA Regulations and this ES summarises the results of the EIA work undertaken.

The EIA Scoping Process

1.7.3 An EIA Scoping Report and a request for an EIA Scoping Opinion pursuant to Regulation 10 of the EIA Regulations was submitted to the Inspectorate on behalf of the Secretary of State on 30 August 2022.

1.7.4 The EIA Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) was developed with reference to standard guidance and best practice and was informed by the EIA team's experience of working on a number of similar projects.

1.7.5 The Secretary of State's Scoping Opinion was received by the Applicant on 10 October 2022 and is presented within **Appendix 1.B [TR030008/APP/6.4]**. The matters raised in the Scoping Opinion have been reviewed and have been taken into consideration in the relevant technical assessments within this ES, in line with Regulation 14(3)(a) of the EIA Regulations. **Appendix 1.C [TR030008/APP/6.4]** provides a summary of how issues raised in the Scoping Opinion have been addressed in the ES.

1.8 Consultation

1.8.1 Consultation is integral to the preparation of DCO applications and to the EIA process. The views of consulted parties and the local community serve to focus the environmental studies undertaken to inform the EIA and to identify specific issues that require further investigation, as well as to inform the design of the Project.

1.8.2 The 2008 Act requires that applicants undertake formal pre-application consultation on their proposals (referred to as "statutory consultation"). There are a number of requirements as to how this consultation must be undertaken and these are set out in the 2008 Act, the EIA Regulations (0) and the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 ("APFP Regulations") (Ref 1-5) as detailed in the **Consultation Report [TR030008/APP/5.1].**

1.8.3 The Applicant has undertaken a comprehensive pre-application consultation programme spanning from August 2022 to the date of submission. The first statutory consultation for the Project took place over a six week period from Monday 9 January 2023 to Monday 20 February 2023. A second statutory consultation took place from Wednesday 24 May 2023 to Thursday 20 July 2023 in relation to a number of proposed changes to the Project.

1.8.4 Both rounds of statutory consultation were carried out in accordance with the statutory requirements of sections 42 (duty to consult), 46 (duty to notify the Secretary of State of the proposed application), 47 (duty to consult local community) and 48 (duty to publicise) of the 2008 Act; Regulations 3 (prescribed consultees) and 4 (publicising a proposed application) of the APFP Regulations, as we well as the EIA Regulations. Full details are provided in the **Consultation Report [TR030008/APP/5.1]**.

1.8.5 During both rounds of statutory consultation information on all key aspects of the Project was provided including:

a. Design and layout.

b. The construction and operation of the required marine infrastructure.

c. The construction and operation of the landside works including the hydrogen production facility.

d. Traffic and access arrangements.

e. Environmental effects on sensitive receptors from impacts such as noise and vibration, air quality, ecology, landscape, archaeology, water use and ground contamination.

f. How impacts are proposed to be controlled, minimised or mitigated.

g. The need for the Project and alternative sites, technologies and layouts considered for the Project and the reasons for the option selected.

1.8.6 A number of face-to-face consultation/exhibition events in Immingham were held where the Project team were available to discuss the Project. Exhibition dates were chosen so that they covered a range of days and times from week to week throughout the statutory consultation in order to be flexible enough for people to attend at a time that suited their own schedule.

1.8.7 In addition, a range of online mechanisms were used so that local communities had access to appropriate information and opportunities to provide feedback without the need to meet in person. This approach, alongside the use of fully accessible, well known and centrally located venues within the local community, reduced barriers to participation and gave people a range of opportunities to engage.

1.8.8 The issues that were raised through consultation, and how these have been considered and addressed within the Project design evolution and the EIA, are set out in the **Consultation Report [TR030008/APP/5.1]** and summarised, as relevant, in each technical chapter (**Chapters 6 to 24**) of this ES **[TR030008/APP/6.2]**. The Consultation Report includes a separate section on EIA-related consultation as recommended within *PINS Advice Note Fourteen: Compiling the Consultation Report* (Ref 1-6).

The Preliminary Environmental Information Report ("PEI Report")

1.8.9 The PEI Report was prepared to satisfy the requirements of Regulation 12(2) of the EIA Regulations and was made available for review and comment at the first statutory consultation.

1.8.10 In accordance with Regulation 12(2)(b), the PEI Report presents *"the information referred to in Regulation 14(2) which has been compiled by the applicant and is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)".* Regulation 14(2) describes the information to be provided in an ES.

1.8.11 *PINS Advice Note Seven: Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements* (Ref 1-**7**) states: "*A good PEI document is one that enables consultees (both specialist and non-specialist) to understand the likely environmental effects of the Proposed Development and helps to inform their consultation responses on the Proposed Development during the pre-application stage*."

1.8.12 In order to enable consultees to understand the likely environmental effects of the Project, the PEI Report presented preliminary findings of the environmental assessments.

PEI Report Addendum

1.8.13 Through consideration of the responses to the first statutory consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes to the Project were identified, which were then the subject of a second statutory consultation. A PEI Report Addendum was prepared to present any additional or amended PEI associated with the project changes and was provided at the second statutory consultation. The PEI Report was also made available during this consultation.

1.8.14 The second statutory consultation allowed consultees a further opportunity to provide informed comment on the Project, the assessment process and preliminary findings, prior to the finalisation of the Application, including this ES, and for these comments to be taken into account.

1.8.15 Details of the design evolution of the Project are presented in the **Planning, Design and Access Statement [TR030008/APP/7.1]**.

1.9 Environmental Statement

1.9.1 This ES is submitted as part of the suite of documents accompanying the Application. The information presented describes the findings of the EIA. The EIA adopts a realistic worst-case assessment basis, based on the Project design and adopting the principles of the Rochdale Envelope, wherever specific parameters cannot yet be fixed for the Project. This approach is detailed further in **Section 5.7** in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

1.9.2 **Table 1-1** identifies where the information defined by Regulation 14(2) of the EIA Regulations can be found within this ES. It should be noted that relevant information may be found in the ES main document, ES Figures (the figures accompanying the ES) and the ES Appendices (the supporting technical appendices accompanying the ES) and in other documents (as referenced) accompanying the Application.

Table 1-1: Location of information required by Regulation 14(2) within this ES

Specified Information	Location within this ES
A description of the Project comprising information on the Site, design, size and other relevant features of the development.	Chapter 2: The Project **[TR030008/APP/6.2]**
A description of the likely significant effects of the Project on the environment.	Chapters 6 to 25 **[TR030008/APP/6.2]**
A description of any features of the Project, or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment.	Chapters 6 to 25 **[TR030008/APP/6.2]**
A description of the reasonable alternatives studied by the Applicant, which are relevant to the Project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.	Chapter 3: Need and Alternatives **[TR030008/APP/6.2]**
A non-technical summary of the information referred to in sub-paragraphs (a) to (d).	Non-Technical Summary **[TR030008/APP/6.1]**
Any additional information specified in Schedule 4 of the EIA Regulations relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected.	Chapters 6 to 25 **[TR030008/APP/6.2]**

1.9.3 The structure of this ES reflects the assessment topics agreed through the EIA Scoping process.

1.9.4 The ES is set out in four separate volumes:

a. Volume I comprises a Non-Technical Summary ("NTS"), which is a summary of the main document.

b. Volume II is the main document and is structured into chapters, as follows:

i. Chapter 1: Introduction – an introduction to the ES.

ii. Chapter 2: The Project – an overview of the Project and the Site.

iii. Chapter 3: Need and Alternatives – an explanation as to the identified need for the Project together with a summary of the possible alternatives.

iv. Chapter 4: Legislative and Consenting Framework – an overview of the information requirements associated with key legislation and policy of relevance to the Project.

v. Chapter 5: EIA Approach – sets out the key issues identified during consultation and the scoping phase of the EIA, as well as presenting the overarching impact assessment methodology.

vi. Chapters 6 to 24 – these provide the assessments of the likely significant effects of the Project in relation to the environmental topics scoped into the EIA.

vii. Chapter 25: Cumulative and In-combination Effects – explains the process that has been followed in respect of the consideration of cumulative and in-combination effects and provides an assessment of those effects.

viii. Chapter 26: Summary – provides a summary of the key findings of the ES, including the residual likely significant effects and the proposed mitigation measures that would avoid or reduce potential impacts of the Project.

c. Volume III contains the figures which support the ES chapters in Volume II.

d. Volume IV contains the appendices which support the ES chapters in Volume II.

1.9.5 The Application is accompanied by a number of statements that this ES references and should be read in conjunction with the ES including:

a. Lighting Assessment Report **[TR030008/APP/6.4]**.

b. Outline Construction Environmental Management Plan **[TR030008/APP/6.5]**.

c. Outline Decommissioning Environmental Management Plan **[TR030008/APP/6.6]**.

d. Outline Construction Traffic Management Plan including Outline Construction Workers' Travel Plan **[TR030008/APP/6.7]**.

e. Outline Woodland Compensation Strategy **[TR030008/APP/6.8]**.

f. Outline Landscape and Environmental Management Plan **[TR030008/APP/6.9]**.

g. Planning, Design and Access Statement **[TR030008/APP/7.1]**.

h. Schedule of Mitigation and Monitoring **[TR030008/APP7.2]**.

i. Without Prejudice Shadow Habitats Regulations Assessment ("HRA") Derogation Report **[TR030008/APP/7.3].**

j. Consents and Agreements Position Statement (including schedule of other consents and licences) **[TR030008/APP/7.4]**.

k. Statutory Nuisances Statement **[TR030008/APP/7.5]**.

l. Shadow Habitat Regulations Assessment (Stage 2) **[TR030008/APP/7.6]**.

m. Utilities Statement **[TR030008/APP/7.7]**.

n. Equality Impact Assessment **[TR030008/APP/7.8]**.

o. Sediment Contamination Data **[TR030008/APP/7.9]**.

p. Sediment Sampling Plan **[TR030008/APP/7.10]**.

1.10 IEMA Quality Mark and Statement of Competence

1.10.1 AECOM is an Institute of Environmental Management and Assessment ("IEMA") Registered Impact Assessor and holds the IEMA EIA Quality Mark as recognition of the quality of AECOM's EIAs and continuous training of their environmental consultants. As required under Regulation 14(4)(b) of the EIA Regulations, an ES must be accompanied by a statement outlining the relevant expertise or qualifications of those involved in its preparation. A statement of competence of the EIA coordinators and the technical specialists that have provided expert input to the ES is included as **Appendix 1.D [TR030008/APP/6.4]**.

1.11 References

Ref 1-1 UK Government (2008). Planning Act 2008.

Ref 1-2 The Stationery Office Limited (2017). The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 1-3 UK Government (2022). British Energy Security Strategy Policy Paper.

Ref 1-4 Department for Communities and Local Government (2013). Planning Act 2008: Guidance on Associated Development Applications for Major Infrastructure Projects.

Ref 1-5 UK Government (2009) The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Ref 1-6 The Planning Inspectorate (2021). Advice Note Fourteen: Compiling the Consultation Report (Version 3).

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 2: The Project

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 2: The Project

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2 The Project

2.1 Overview of the Project

2.1.1 The Project would comprise the alteration of a harbour facility for the construction, operation and maintenance of a multi-user green energy Terminal to facilitate the import and export of liquid bulks associated with the energy sector, together with associated development. The Terminal includes a jetty and associated loading/unloading infrastructure and pipelines.

2.1.2 Initially, the Terminal would be used for the import and export of green ammonia to be converted to green hydrogen. To facilitate this, a hydrogen production facility, comprising associated ammonia handling equipment, storage and processing units would be constructed as part of the Project. Other proposed uses for the green energy Terminal will come forward in due course and separate applications for landside works for transfer and or storage of other liquid bulks will be submitted as required. It is anticipated that a future use of the Terminal will be the import and export of liquefied carbon dioxide to connect to adjacent carbon transport and storage networks for sequestration in the North Sea.

2.2 Purpose and Objectives

2.2.1 The objectives of the Project are:

a. To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone.

b. To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH_3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist in the UK's transition towards net zero.

b. To deliver and operate new port infrastructure, and its first user's hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham.

c. To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community.

d. To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

2.2.2 An overview of the green hydrogen production process is provided in **Appendix 2.C [TR030008/APP/6.4]**.

2.3 Project Site Description

2.3.1 The following sections describe the location, nearest sensitive receptors, features and elements associated with the Project Site (the 'Site') and the surrounding environment as illustrated on **Figure 2.1 [TR030008/APP/6.3]**.

Project Location

2.3.2 The Site is located in North East Lincolnshire on the south bank of the Humber Estuary to the east of the Port. **Figure 1.1 [TR030008/APP/6.3]** illustrates the Project's location, which is approximately centred on National Grid Reference ("NGR") E520783 N415271. The Site includes a marine area within the Humber which would support the multi-user green energy Terminal and adjacent terrestrial areas which would support the landside infrastructure forming part of the Terminal and related associated development, including the hydrogen production facility, which would be developed across two main sites (the 'East Site', and the 'West Site'), which are first referenced in **Chapter 1: Introduction [TR030008/APP/6.2]**.

2.3.3 The land-side works fall within the administrative boundary of North East Lincolnshire Council ("NELC"), as illustrated on **Figure 2.2 [TR030008/APP/6.3]**. The marine-side works, that extend seaward and fall beyond the local authority's boundary, would take place in the bed of the Humber Estuary, which is owned by the Crown Estate and over which the Applicant has the benefit of a long lease. The Project in its entirety covers an area of approximately 121ha.

2.3.4 The Order Limits, as represented in **Figure 1.1 [TR030008/APP/6.3]** by the Site Boundary, have been refined through ongoing studies and taking into account the responses to the Applicant's consultation.

2.3.5 The Site is situated to the east of the Port and largely outside of the operational area of the Port. The area surrounding the Port is industrial in nature, being dominated by chemical manufacturing, oil processing and power generation facilities. Residential and commercial properties are present to the south of the Port on Queens Road and lie within, and adjacent to, the Site Boundary. Beyond the industrial facilities, the wider area is largely agricultural. The nearest residential area is on the eastern edge of the town of Immingham approximately 460m from the western edge of the Site.

2.3.6 The Port lies immediately adjacent to the main deep-water shipping channel which serves the Humber Estuary, thereby enabling access to the Port by some of the largest vessels afloat. The Port has good access for road haulage to the M180 Motorway and from there to the M1 Motorway or the A1, via the M18 Motorway. In addition, the Port has its own rail terminal, with some 25% of all rail freight in the UK originating from the Port. This primarily connects to local power stations and steel works moving circa 10 million tonnes of cargo per annum by rail.

History of Site and Surroundings

2.3.7 Available historical maps from the Groundsure Report (Ref 2-1) for the Site have been studied to determine the previous land uses within the area of the Site and immediately surrounding the Site Boundary. The mapping shows no notable development on the Site until 1930–31 when residential housing is shown on Queens Road adjacent to the Site boundary. In addition, the L.N.E.R Grimsby District Electric Light Railway is shown through the centre of the Site. A sewage works was established by 1922 adjacent to south of the Site boundary and is still present.

2.3.8 No notable land use changes occurred at the Site until the period 1951–56. At this time a Gypsum Disposal Bed is shown as being present adjacent to the Site Boundary at the south-western extent. Buildings and railway lines associated with a Chemical Factory were shown as being established approximately 350m south-east of the Site Boundary.

2.3.9 By 1964, the Port had developed more extensively, including the establishment of jetties within the Humber, to the west of the area proposed for the Immingham Green Energy Terminal ("IGET"). By this time a number of small buildings are mapped as present on the western part of the Site, whilst electricity lines run through the East Site. No notable changes have occurred within the Site since this period other than further electricity pylons which were erected across the western part of the Site and also pipelines on the northern boundary of the Site which were established during the period 1969–72.

2.3.10 Multiple changes have occurred between 1964 and the present day in areas within 500m of the Site Boundary. The industrial landscape has continued to develop, including but not limited to the establishment of an Oil Storage Depot and associated infrastructure, further structures associated with the sewage works (now an Anglian Water operational facility), pipelines, and most recently, by 2010 the establishment of a Recycling Centre.

2.3.11 Some of the mapped infrastructure including the mapped Chemical Works and associated railway lines have become disused between 1969 and the present day.

Existing Environment and Land Use

2.3.12 The proposed Terminal would extend seawards into the Humber Estuary and the jetty would be located to the east of the existing Immingham Oil Terminal jetty. This area falls within the boundaries of the Humber Estuary Special Area of Conservation ("SAC"), Special Protection Area ("SPA") and Ramsar Site, which collectively form the Humber European Marine Site ("EMS").

2.3.13 The corridor which links the proposed Terminal to the East Site includes a section of woodland known as 'Long Strip' between Laporte Road and the Humber Estuary that is subject to a Tree Preservation Order ("TPO"). A bridleway, Bridleway 36, runs through the eastern edge of the Long Strip, connecting users from Laporte Road to the coastal path that follows the Humber Estuary east to Grimsby as shown in **Figure 2.1 [TR030008/APP/6.3]**.

2.3.14 The East Site itself comprises two parcels of land, which are bisected by Laporte Road. The first parcel of land consists of an area of hardstanding to the north of Laporte Road which is currently in use by the Applicant as a storage area. The second parcel of land is a triangular shaped area of brownfield land that is currently covered by gravel and various stockpiles, which is accessed via Queens Road (A1173) and lies to the south of Laporte Road. The Associated Petroleum Terminal works complex is situated to the north/north-east of the East Site, whilst to the south are various industrial facilities. To the west and north-west is the Port and associated industrial facilities and the 'Immingham Dock East Gate' Port entry point from Queens Road. To the south-east of the East Site is the Long Strip woodland described above and the Anglian Water Sewage Treatment Works (accessed via a private road off Queens Road) noted in **Paragraph 2.3.7**.

2.3.15 The West Site currently comprises three agricultural fields, which are bounded by linear hedgerows and drainage ditches. An electrical sub-station and a gas-fired power generator installation are situated to the north-west. The north-west and western boundaries of the West Site are defined by Kings Road and the A1173, including the Grimsby to Immingham 'Cycle Superhighway' which runs along the A1173 between the Kings Road and Kiln Lane roundabouts. A landfill is located to the south separated by a landscape buffer strip. Queens Road forms the north-eastern boundary of the West Site with a number of residential and mixed residential / commercial properties located within the Site Boundary. The east and south-eastern boundary is adjacent to another gas fired power generator installation, a community recycling centre and a large waste gypsum landfill. A short tarmac access road has been constructed from Kings Road into the West Site, associated with an extant planning consent. A series of overhead power cables run across the middle and southern boundaries of the West Site, with a buried mains water and a buried high-pressure gas pipeline present along the southern boundary. The existing utilities, as currently known, are detailed within the **Utilities Statement [TR030008/APP/7.7]**.

2.3.16 A proposed Pipeline Corridor would connect the West Site to the East Site. It would run through an area that has been impacted by industrial development alongside Queens Road and Laporte Road, and would also run underneath the Grimsby Docks Branch Line.

Potential Sensitivities/Receptors in the vicinity of the Site

Properties

Residential Receptors

2.3.17 The closest residential receptors to the Site include:

a. A total of ten residential properties located on the west side of Queens Road as follows:

   i. Houses at Numbers 1-5 and 31 Queens Road (six houses in total).

   ii. Number 6 Queens Road (two flats in total).

iii. Numbers 7-8 (one flat) and 18 Queens Road (one flat), with these flats on the upper floors above commercial interests on the ground floors (two flats in total).

b. These properties have been included within the Site Boundary as their continued residential use presents an impediment to the obtaining of hazardous substances consent in connection with the operation of the proposed hydrogen production facility and hydrogen storage on the West Site (see **Section 2.4.7** of this chapter and **Chapter 22: Major and Accidents and Disasters [TR030008/APP/6.2]** for further information).

c. Residential properties on the eastern edge of Immingham, including Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk, Kendal Road, Chestnut Avenue, Waterworks Street and Spring Street, which at the closest point are located between approximately 460m and 480m west of the West Site.

d. Mauxhall Farm off Stallingborough Road, located approximately 1km south-west of the West Site.

2.3.18 Other settlements nearby include: Grimsby (approximately 5km) to the south-east; Healing (approximately 3.5km) and Great Coates (approximately 5.5km) to the south-east; Stallingborough (approximately 2.5km) to the south; Keelby (approximately 5km) to the south-west; and Habrough (approximately 4.5km) to the west.

Business/Commercial Receptors

2.3.19 As noted in **Paragraph 2.3.17**, Numbers 7-8 and 18 Queens Road are located within the Site Boundary as they contain residential uses at first floor level. Numbers 7-8 Queens Road contains vacant commercial premises at ground floor level. The ground floor at 18 Queens Road is understood to be used by the owner for storage. Acquisition of these properties is being sought, given that their use is, in part, residential as described in **Paragraph 2.3.17**. There are a number of other business/commercial receptors adjacent to the Site Boundary in the vicinity of Queens Road. It is considered that the continued use of these business / commercial properties would be compatible with the operation of the hydrogen production facility following assessments undertaken on behalf of Air Products. The relationship between land uses will also be considered by the Health and Safety Executive ("HSE") in connection with the application for Hazardous Substances Consent.

Consultation with Owners and Occupiers

2.3.20 Discussions with the owners and occupiers of the residential and commercial properties directly impacted by the Project are ongoing.

2.3.21 Discussions with the landowners/occupiers of the residential and part residential properties on Queens Road referred to above are ongoing with a view to negotiating their acquisition. At present one residential property has been acquired. Where it is not possible to acquire those properties through negotiation, acquisition powers for these properties will be sought through the Development Consent Order ("DCO").

2.3.22 In addition to requiring Hazardous Substances Consent, the hydrogen production facility will be regulated by the Control of Major Accident Hazards ("COMAH") Regulations 2015 (as are certain existing premises in the Port). Discussions with any likely affected landowners and occupiers in terms of any implications for the safety planning of their operations in connection with COMAH requirements have taken place and will be ongoing.

Air Quality Receptors

2.3.23 There are no Air Quality Management Areas ("AQMA") within the Site or surrounding area. Immingham itself has historically had an AQMA, close to the Port on Kings Road, due to elevated concentrations of PM_{10} concentrations that are now well below the relevant air quality objectives.

Ecological Receptors

2.3.24 That part of the Site boundary within the Humber is within the boundary of the Humber Estuary EMS, which is a statutory designated site that encompasses the Humber Estuary SPA, SAC, RAMSAR and Site of Special Scientific Interest ("SSSI") designations.

2.3.25 Laporte Road Brownfield Site Local Wildlife Site ("LWS") is located approximately 150m south-east of the Site.

2.3.26 The mature broad-leaved deciduous woodland of Long Strip is described in **Paragraph 2.3.13** above. This area is subject to a TPO which applies to the whole woodland belt, including the area on the south side of Laporte Road. A veteran ash tree is present in the north-east corner of the woodland as shown on **Figure 2.1 [TR030008/APP/6.3]**.

Traffic and Transport Receptors

2.3.27 Access to the West Site would use new accesses off Kings Road and a new access onto the A1173. Access to the East Site would be off a private road off Queens Road and Laporte Road. Queens Road is a single carriageway road providing a link from the Port, crossing the Grimsby Docks Branch Line on a bridge and runs towards the A1173, where it becomes Kings Road. Kings Road is also a single carriageway, which forms a three-arm roundabout junction with the A1173, where Kings Road then continues to the north to form a link into Immingham and then to the A160 to the north. The A160 heads west and connects with the A180. Temporary access points would be required during Project construction, including access for the Temporary Construction Areas, from Queens Road and Laporte Road. A new permanent access point would also be provided off Laporte Road for the jetty access road. The speed limit on Laporte Road varies at present between national speed limit and 40mph. A

permanent reduction to the speed limit on Laporte Road has been determined to be necessary to ensure the safety of road users and a permanent 30mph speed limit is therefore proposed for the length of Laporte Road between the junction with Queens Road and the Tronox site entrance. This change is supported, in principle, by NELC. Further details on Site access and traffic management proposals are set out in **Section 2.6**.

2.3.28 From the three-arm roundabout junction with Kings Road, the A1173 continues south as a single carriageway to form a three-arm roundabout with Kiln Lane before continuing south to form a grade separated junction with the A180. The A180 is part of the strategic road network ("SRN") and is maintained by National Highways. The A180 heads east to Grimsby and west towards the closest motorway (M180) and provides the link from the local area to the wider highway network within the region.

2.3.29 Public Right of Way Bridleway 36, described above, runs through the eastern edge of the strip of woodland known as 'Long Strip', and connects to the coastal path along the Humber. The coastal path forms part of the proposed route for the improvements proposed by Natural England to the England Coast Path between the Humber Bridge and Easington (to the north of the Humber) and Mablethorpe to Humber Bridge (to the south of the Humber). Part of the proposed upgraded route is located within the Site. The bridleway would be temporarily diverted during the first phase of construction of the Project, but it would be re-opened during the Project's operational phase.

2.3.30 Pedestrian facilities are limited on the local road network in the vicinity of the Site, with a footway along one side of Queens Road and along the north side of the A1173 King Road providing a link into Immingham.

2.3.31 Some parts of the Site, which are currently unfenced but are not Public Rights of Way, are currently accessed informally by a small number of local walkers and recreational sea anglers (on the sea wall). The informal access along the existing sea wall between the Associated Petroleum Terminal ("APT") Jetty to the north-west of the Site and at the point at which the Bridleway 36 meets the sea wall would need to be stopped up and removed permanently to enable construction and operation of the new Terminal. Informal access through the southern part of Long Strip woodland, south of Laporte Road, would also be stopped up temporarily during construction. This is considered in detail in **Chapter 23: Socio-economics [TR030008/APP/6.2]**.

Cultural Heritage Receptors

2.3.32 There are no World Heritage Sites, Scheduled Monuments, Grade I and II* listed buildings, conservation areas, registered parks and gardens, registered battlefields, or protected wreck sites within 2km of the Site. There is one Grade II listed building located within 2km of the Site, this being the Immingham War Memorial (NHLE 1455139). A further two Grade II listed buildings, Churchfield Manor (NHLE 1161630) and the Iron Bungalow (NHLE 1391349), are located slightly further away than 2km from the Site.

Landscape and Visual Receptors

2.3.33 The existing landscape/seascape and visual baseline is heavily influenced by the existing industrial presence located around the Port. This includes several deep-water jetties for bulk cargo and terminals for oil and gas. The seascape of the Humber varies in quality and character along its length, with expansive areas of tidal mudflats and saltmarsh contrasting with more developed industrial areas. Sensitive visual receptors are relatively limited, with the main concentration being residents in the nearby settlement of Immingham to the west. However, there are several residential receptors located on Queens Road as described above and recreational receptors use Bridleway 36. Existing views from most locations include the structures and infrastructure associated with the working port and other adjacent industrial development.

2.3.34 Part of the Site and landscape and visual study area fall within The Humber Estuary National Character Area ("NCA"). The character area is broadly split into two components, the largest being the expanse of water associated with the Humber Estuary. The character area provides a varied landscape, with open and extensive views across remote and rural areas, contrasting with heavy industry associated with towns and ports.

2.3.35 The Site lies within Marine Character Area ("MCA") 6: Humber Water, which is the second largest coastal plain estuary in the UK and is bound by intertidal mud and sand flats and saltmarsh. These habitats provide internationally important wildlife corridors (described under Ecological Receptors above). The character area contains the UK's largest port complex and views are dominated with an extensive and complex mix of industrial, commercial, agricultural, residential and tourism land uses. Shipping traffic using the local ports provide a dominant animated feature.

2.3.36 The Site is also located within Regional Character Area ("RCA") 3: The Northern Marshes, which is defined by the industrial features along the coast clustered around the deep-water Port of Immingham. The RCA is visually dominated by large and tall structures, such as Lindsay Oil Refinery, which are linked with the Port and heavy industry.

2.3.37 The Site is also within Local Landscape Character Area ("LCA") A – Humber Estuary, as defined by the NELC Landscape Character Assessment (Ref 2-2). Area A – Humber Estuary is then subdivided into three Local Landscape Types ("LLTs"), which the Site and study area lie within:

a. LLT 1 Industrial Landscape

a. LLT 2 Open Farmland

b. LLT3 Wooded Open Farmland

Topography, Land Quality and Geological Receptors

2.3.38 The topography of the Site is low-lying and flat with many areas being as historically reclaimed land. An extensive network of man-made ditches provides Site drainage which flows to larger drains which are pumped to the Humber.

2.3.39 The Provisional Agricultural Land Classification ("ALC") Grade Map on MAGIC Map Application (Ref 2-3) indicates that the East Site and Pipeline Corridor are designated as Grade Urban, whilst most of the West Site and the eastern half of the Laporte Road Temporary Construction Area adjacent to the Humber Estuary have been designated as ALC Grade 3.The western half of the Temporary Construction Area is designated as ALC Grade Urban. An ALC survey has been undertaken within the West Site and Laporte Road Temporary Construction Area adjacent to the Humber Estuary. The results indicate the soils in the surveyed locations are ALC Grade 3b, and therefore are not considered best and most versatile ("BMV").

2.3.40 The solid geology across the entire Site is characterised by the Flamborough Chalk Formation. There are superficial deposits comprising Beach and Tidal Flat Deposits and Tidal Flat Deposits associated with the Humber Estuary. Made Ground is anticipated to be presented across the majority of the Site.

Hydrological and Flood Risk Receptors

2.3.41 The Humber Estuary includes the marine areas required for the proposed Terminal and also forms the north-eastern boundary of the Site. North Beck Drain, Middle Drain and Habrough Marsh Drain are all located in the vicinity of the Site as shown in **Figure 18.2 [TR030008/APP/6.3]**.

2.3.42 The Environment Agency Flood Map for Planning (Ref 2-5) identifies that the landside part of the Site is located entirely within Flood Zone 3a. However, the Site is afforded protection from tidal flood defences that are in place along the entire south bank of the Humber Estuary. These tidal flood defences provide protection against a flood event with a 0.5% chance of occurring in any year, therefore the likelihood of a flood event occurring from overtopping or failure of the defences is considered to be low due to the presence of flood defences.

2.3.43 There are no historical flood records from groundwater flooding within the Site or the wider Port of Immingham area, whilst the Site is also at very low to low risk of flooding from surface water sources.

2.3.44 Anglian Water asset mapping shows that there is no surface water drainage infrastructure operated by them within the Site. An Anglian Water foul sewer main and the Immingham Sea Outfall are located in proximity to the Site. Surface water from hard standing areas is generally discharged directly to the adjacent watercourses and ultimately to the Humber Estuary, or directly to the Humber Estuary.

2.4 Project Description

Overview

2.4.1 The project for which development consent is sought is defined by **Schedule 1: Authorised Project** of the **draft DCO [TR030008/APP/2.1]** and the location of each Work No. within the Site is shown on **Figure 2.3 [TR030008/APP/6.3]** and on the **Works Plans [TR030008/APP/4.2]**). The design of the Project incorporates flexibility in the final dimensions and configurations of buildings and structures, notably in relation to the hydrogen production facility, to allow for future detailed design development. In contrast, less flexibility will be possible for the marine elements of the Project, as the proposed alignment, length and pile density of the jetty has been subject to extensive physical processes modelling to define a preliminary design which minimises the impacts on the habitats of the Humber Estuary. However, the design of the marine infrastructure will continue to be refined as the detailed engineering design is developed and that the final design will be approved further to the terms of the **Deemed Marine Licence** which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]**. The relevant parameters (lateral and vertical) for each part of the works and the extent to which designs have a greater degree of certainty (primarily the jetty) are covered in greater detail as relevant in subsequent paragraphs.

2.4.2 In order to ensure a robust assessment of the likely significant environmental effects of the Project, the Environmental Impact Assessment ("EIA") was undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate. This involves assessing the maximum (or where relevant, minimum) spatial and vertical parameters for each Work No.. Where this approach is being applied to the specific aspects of the EIA, this is confirmed within the relevant chapters of this Environmental Statement ("ES"). As such, the ES presents a reasonable worst-case assessment of the potential impacts of the Project. **Chapter 5: EIA Approach [TR030008/APP/6.2]** explains further the concept of the 'Rochdale Envelope', the use of parameters and the meaning of a 'reasonable worst case' to undertake EIA.

2.4.3 The works which comprise the Project are defined in **Schedule 1: Authorised Project** of the **draft DCO [TR030008/APP/2.1]** which provides the full description of all elements of each Works No. The locations of Work No. 1 through to Work No. 10 within the Site are shown on the **Works Plans [TR030008/APP/4.2]**). The following is a summary of the main elements of each of Work Nos 1-10:

a. The Nationally Significant Infrastructure project ("NSIP"), **Work No. 1**, comprising:

   i On the marine side, a Terminal for liquid bulks: comprising:

      A. A jetty (defined by **Work No. 1a**) including a loading platform, associated dolphins, fenders and walkways, topside infrastructure but not limited to control rooms, marine loading arms, pipe-racks, pipelines and other infrastructure.

      B. A single berth, with a berthing pocket with a depth of up to 14.5m below chart datum.

ii related landside infrastructure including, but not limited to, a jetty access ramp, a flood defence access ramp and works to raise the seawall locally under the jetty access ramp.

b. Associated Development on the landside, comprising:

i A corridor between the new jetty and Laporte Road which would support a private road (the 'jetty access road'), pipe-racks, pipelines to enable the ammonia import to the East Site, as well as security gates, a security building, a power distribution building and associated utilities – (**Work No. 2**).

ii 'East Site - Ammonia Storage' (**Work No. 3**) on which an ammonia storage tank and related plant including an ammonia tank flare stack would be constructed (**Work No. 3a**) as well as additional buildings (including welfare building, power distribution building and a process instrumentation building), pipe-racks, pipelines, pipes, cable-racks, utilities and other infrastructure.

iii Construction of a culvert (**Work No. 4**) under Laporte Road for pipelines, pipes and cables and other conducting media linking the two parts of the East Site.

iv 'East Site – Hydrogen Production Facility' (**Work No. 5**) on which up to three hydrogen production units and associated plant including flue gas stacks and flare stacks would be constructed (**Work No. 5a**) together with additional buildings (including process control building, power distribution buildings, process instrumentation buildings, analyser shelters), pipe-racks, pipelines, pipes, utilities and other infrastructure.

v Underground pipelines, pipes, cables and other conducting media (**Work No. 6**), between the East and West Sites, for the transfer of ammonia, hydrogen, nitrogen and utilities, with cathodic protection against saline corrosion.

vi 'West Site' (**Work No. 7**) involving the construction of up to three hydrogen production units with associated flue gas stacks and flare stacks and up to four liquefier units (**Work No. 7a** and **Work No. 7b** combined); hydrogen storage tanks, hydrogen trailer filling stations, a hydrogen vent stack and associated process equipment (**Work No. 7c**); and hydrogen vehicle and trailer filling stations, hydrogen compressors and associated process equipment (**Work No. 7d**). Also additional buildings (including but not limited to control room and workshop building, security and visitor building, contractor building, warehouse, driver administration building, safe haven building, electrical substation and metering station, power distribution buildings, process instrumentation buildings, analyser buildings and additional temporary buildings during construction), process and utility plant including cooling towers and pumps, fire water tank, instrument air equipment, pipe-racks, pipelines, pipes, cable-racks, utilities and other infrastructure.

vii Formation of temporary construction and laydown areas on Queens Road (**Work No. 8**) and off Laporte Road (**Work No. 9**).

viii Temporary removal of street furniture and modification of overhead cables on Kings Road (**Work No. 10**) associated with the transport of large construction components from the Port to the Site.

2.4.4 In addition to Work No. 1 to 10 which are each spatially defined within the **Works Plans [TR030008/APP/4.2], Schedule 1: Authorised Project** of the **draft DCO [TR030008/APP/2.1]** includes 'Further associated development' and 'Ancillary Works' which both extend across the full extent of the Site.

2.4.5 In broad terms, 'Further associated development' would be the undertaking, as required, of works such as site clearance, creation of additional construction compounds, utility works, landscaping works and street works on a site wide basis.

2.4.6 'Ancillary works' constitute works that would not necessarily constitute development, such as vegetation removal, the installation of fencing and the demobilisation of construction works.

Site Boundary and Design Evolution

2.4.7 The extent of land potentially required to implement the Project, referred to as the Site Boundary, are illustrated on **Figure 1.1 [TR030008/APP/6.3]**. The Site Boundary represents the proposed Order Limits for the purposes of development consent.

2.4.8 Through consideration of the responses to two Statutory Consultations, the developing environmental assessments and through ongoing design-development and assessment, the design of the Project has evolved and a number of refinements and modifications have been made.

2.4.9 After submission of the Scoping Report, the design of the Project was developed to include up to two berths on the jetty, instead of a single berth, in order to enable a variety of vessels sizes. It has since been determined that the vessels can be accommodated on a single berth and the design has reverted to the single berth described under the description of works provided above.

2.4.10 Further consideration of the alternatives considered are provided in **Chapter 3: Need and Alternatives** of the ES **[TR030008/APP/6.3]**.

2.4.11 Limited changes have also been made to the proposed Site Boundary since the Scoping Report and since submission of the first Statutory Consultation. The changes made to the Site Boundary since the first Statutory Consultation were consulted on during the second Statutory Consultation. Further limited changes that have been made to the Site Boundary since the second Statutory Consultation have been to reduce the extent of the area required. The main reductions were reducing the areas required for temporary works, as well as removing the solely commercial properties on Queens Road from the Site Boundary. The changes to the Site Boundary are illustrated in **Figure 2.4 [TR030008/APP/6.3]**.

Parameters

Introduction

2.4.12 The parameters detailed here, alongside Schedule 1 of the **draft DCO [TR030008/APP/2.1]** and the **Works Plans [TR030008/APP/4.2]** form the basis of the technical assessments undertaken in the EIA. The parameters are of three broad types, as follows:

a. **Lateral parameters:** The lateral parameters for each element of the development comprise the boundary for each of the defined work areas as set out in the **Works Plans [TR030008/APP/4.2]**. This approach enables the detailed design to be developed within the authorised work areas, whilst also providing spatial definition to the largest components (for example, the location of the ammonia storage tank can only take place within the area defined as Work No. 3a, rather than anywhere within Work No. 3 as a whole). The alignment of the jetty, which forms the main component of the Terminal (Work No. 1), is defined on the marine side within relatively narrow parameters (Work 1a) because the design of the jetty has been developed such that it minimises the impacts on the intertidal habitats of the Humber and modelling indicates that there is relatively little tolerance in the possible alignment. Work No. 1a is defined further by additional parameters (see below) given in **Table 2-1** and which are secured by the **Deemed Marine Licence** which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]**.

b. **Vertical parameters:** The vertical parameters for each work number are defined in **Table 2-1** (for Work No. 1a) and **Table 2-2** (for all other Work numbers). The vertical parameters define a 'ceiling', or upper limit, for any permanent building or structure (such as stacks) within each of the works areas. In the case of flue and flare stacks, minimum heights are also defined to ensure adequate dispersion of emissions. These vertical limits are defined for Work No. 1 alongside the other parameters which are secured by the Deemed Marine Licence which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]** and for all other work numbers, the vertical parameters are set out in the Requirements which form Schedule 2 of the **draft DCO [TR030008/APP/2.1**]. The vertical parameters are set out in **Table 2-1** below (for Work No. 1, with reference to Chart Datum) and **Table 2-2** below (for all other Works, by reference to finished ground levels ("FGL") and Ordnance Datum).

c. **Additional parameters:** Work No. 1a is defined further by additional parameters, such as maximum pile number and maximum pile size, which underpin the modelling of the proposed layout and so are also defined in **Table 2-1.** For example, final pile numbers may vary as the design of the Project is refined but only to the extent that pile number may be less than stated, not more, and therefore the ongoing development of the jetty design does not lead to a worse adverse effect on the intertidal habitats of the Humber than that assessed in the EIA.

Marine parameters

2.4.13 The parts of Work No.1 comprising the approach jetty, the jetty head and loading platform including breasting dolphins and mooring dolphins that lie to the seaward side of the mean high water springs mark will be constructed within the parameters for Work No.1a shown on Sheets 1 to 4 of the **Works Plans [TR030008/APP/4.2]**. The dredge pocket will be located in accordance with the co-ordinates for it provided in a Condition of the Deemed Marine Licence which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1].** The details that have been used as the basis for the modelling reported in the marine chapters of this **ES [TR030008/APP/6.2]** and the **Shadow Habitats Regulation Assessment Report [TR030008/APP/7.6]** are primarily (i) the orientation of the jetty, defined by Work 1a, (ii) the number of piles and pile diameters (in the marine environment, see **Table 2-1** below) and (iii) the geometry of the dredge pocket.

2.4.14 **Table 2-1** below provides the parameters for the Terminal (Work No. 1a). These parameters are secured by their inclusion within the Outline **Construction Environmental Management Plan ("CEMP") [TR030008/APP/6.5],** which is itself secured by a Requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1]**.

Table 2-1: Parameters for Work No. 1a

Work element	Parameter
Jetty head and related topside infrastructure	Jetty head– up to +13.5m above chart datum Topside infrastructure – up to +35m above chart datum
Mooring dolphins	Up to eight mooring dolphins, to the east of the jetty head and four to the west of the jetty head. Each dolphin up to 13m long and up to 15m wide with a height of up to +[13.5]m above chart datum
Approach jetty length	Up to 1,200m
Approach jetty height	Up to +13.5m above chart datum
Approach jetty width	Up to 14m wide save for in the location of vehicle passing places where it will be up to 17m wide and in the vicinity of the jetty operations building where it will be up to 27m wide
Pile number and spacing	Approach jetty between point "A" in Sheets 3 & 4 of the **Works Plans [TR030008/APP/4.2]** and point "B" on Sheet 2 & 3 of the **Works Plans [TR030008/APP/4.2]** – up to 59 piles each with maximum diameter of 1.2m with pile rows spaced at a minimum of 25m (save for the final row at point B as the jetty changes angle where the separation will be less than 25m) and no more than four piles per row (save for the location of the jetty operations building where there will be no more than seven per row

Work element	Parameter
	and vehicle passing places where there will be no more than five per row). Approach jetty between point "B" on Sheets & 3 of the **Works Plans [TR030008/APP/4.2]** and point "C" on Sheets 1 & 2 of the **Works Plans [TR030008/APP/4.2]** – up to 156 piles each with a maximum diameter of 1.2m and no more than four piles per row (save for the location of vehicle passing places where there will be no more than five per row) Jetty head and breasting dolphins – up to 104 piles (each up to 1.5m diameter) Mooring dolphins – up to 72 piles (each up to 1.5m in diameter) across up to eight mooring dolphins Two monopole fenders each up to 2.3m in diameter

Terrestrial parameters

2.4.15 **Table 2-2** defines the vertical parameters for the above ground landside elements (Work No. 2, 3, 5 and 7).

Table 2-2: Vertical Parameters for landside elements

Work No.	(2) Maximum built element height	(3) Maximum finished ground level	(4) Built element	(5) Minimum built element height
Work No.2	15m above finished ground level	5.0m above ordinance datum		
Work No.3 (except Work No.3A)	20m above finished ground level	3.5m above ordinance datum		
Work No.3A	65m above finished ground level	3.5m above ordinance datum		
Work No.5 (except Work No.5A)	20m above finished ground level	3.8m above ordinance datum		
Work No.5A	45m above finished ground level	3.8m above ordinance datum	Hydrogen production unit flare stack	37m above finished ground level

Work No.	(2) Maximum built element height	(3) Maximum finished ground level	(4) Built element	(5) Minimum built element height
Work No.7 (except Work Nos. 7A, 7B, 7C and 7D)	20m above finished ground level	2.5m above ordinance datum		
Work No.7A, 7B and 7C	45m above finished ground level	2.5m above ordinance datum	Hydrogen production unit flare stack	37m above finished ground level
Work No. 7D	15m above finished ground level	2.5m above ordinance datum		

2.4.16 Where applicable, the technical assessment chapters of the **ES [TR030008/APP/6.2]** detail how the parameters detailed above have been considered within the individual topic assessments undertaken.

Project Components

Introduction

2.4.17 This section provides further indicative details regarding the Project components which were introduced in **Paragraph 2.4.3** above and are presented sequentially from the NSIP (Work No.1) to Work No. 10. It is important to note that **approval is not sought for illustrative layouts or indicative details.** Any such information presented in tables, drawings and plates is clearly marked accordingly. **The illustrative layouts and indicative details are included here solely to assist in the understanding of the Project and how the Work Plans have been developed, but the EIA has not been undertaken by reference to them.**

2.4.18 The indicative details are presented in a number of forms. **Table 2-3** to **Table 2-9** which follow below provide indicative details of the main buildings listed in Schedule 1 for Work Nos. 1, 2, 3, 5 and 7 (Work Nos. 4 and 6 are for underground works only and have no buildings). As set out in Schedule 1, each of these works will also include a wide range of other structures and equipment and all of the buildings, structures and equipment will be constructed within the maximum height limits defined in **Table 2-1** and **Table 2-2** above. Illustrative layouts, sections and elevations are provided as **Illustrative Layouts [TR030008/APP/4.3]** and **Illustrative Sections and Elevations [TR030008/APP/4.4]** and an illustrative Project layout is also presented in this chapter as **Figure 2.5 [TR030008/APP/6.3]**.

Marine Infrastructure (the NSIP or principal development)

Terminal (Work No. 1)

2.4.19 The Terminal would comprise the construction during Phase 1 of a new jetty located in the Humber to the east of the existing Immingham Oil Terminal jetty. A new in-river jetty with one berth, including topside infrastructure, is proposed that would have the capacity to facilitate the import and export of liquid bulk products. The berth would be capable of handling a variety of vessels, of between 100 - 250m in length over all ("LOA") with draughts of up to 12.8m. The associated hydrogen production facility, to be operated by Air Products and described below, would be the first user of the jetty facility for the import of green ammonia to be converted to green hydrogen. The other liquid bulk products are expected to include products such as liquefied CO_2 for the purpose of carbon capture and storage via connection to proposed CO_2 transport infrastructure being developed close to the Port.

2.4.20 The preliminary design of the jetty has been subject to extensive optioneering and modelling to develop a design which minimises, so far as is possible, habitat loss on the intertidal habitats of the Humber. The alternative designs and the reasons they were not taken forward are summarised in **Chapter 3: Need and Alternatives** of the **ES [TR030008/APP/6.2]** and also, specifically in relation to Habitat Regulation Assessment, in the **Without Prejudice Shadow Habitats Regulations Assessment ("HRA") Derogation Report [TR030008/APP/7.3].**

2.4.21 The preliminary design of the Terminal is shown in **Figure 2.5 [TR030008/APP/6.3]** and **Illustrative Layouts [TR030008/APP/4.3]** and **Illustrative Sections and Elevations [TR030008/APP/4.4]**. The location and orientation of the jetty in the marine environment is defined within Work No. 1a shown on the **Work Plans [TR030008/APP/4.2]** which reflects the extent to which the preliminary design has had to be developed to ensure adverse effects on the protected ecological sites on the Humber have been minimised. The much wider extent of Work No. 1 (i.e. beyond Work No. 1a) defined on the **Work Plans [TR030008/APP/4.2]** is primarily to provide for construction working width and near-shore construction vessel movements rather than to provide flexibility for the future jetty design.

2.4.22 The marine infrastructure for the Terminal which comprises Work No. 1 would consist of the following operational components:

a. An open piled jetty approach trestle, up to 1.2km in length, which would extend from the river frontage in a north-easterly direction leading to the jetty head structure and which would provide access for vehicles and pipework to and from the shore to the berth. The approach trestle would be 14m wide for the main length with increased widths of 17m and 27m for passing places and an operations building respectively. The jetty approach connects to a jetty head to provide the berth. The jetty approach would be supported by up to 219 steel tubular piles (215 marine piles and four landside piles), which with a diameter of up to 1.2m.

b. The jetty head would comprise (un)loading platforms and two breasting dolphins with fenders. The jetty head would be supported by up to 106 piles comprising up to 104 piles with a diameter of up to 1.5m and two monopiles (located in front of the jetty head/loading platform to provide fendering suitable for small vessels) with a diameter of up to 2.3m. The berth would support large (with a draught up to 12.8m) and small vessels.

c. Eight mooring dolphins linked to each other and to the jetty head by high level walkways to facilitate operational and maintenance access. The mooring dolphins would each be supported by 9 steel tubular piles with a diameter of up to 1.5m (72 piles in total).

d. A jetty head building and a separate refuge shelter with attached office, WC and external safety shower located on the jetty head, the latter to provide a safe and secure area for personnel in the event of an emergency.

e. A jetty operations building near the landside end of the jetty approach to house control/operations function and various electrical equipment (switch room, operations room and welfare facilities).

f. Appropriate topside infrastructure installed on the jetty head and approach jetty to load and unload vessels including marine loading arms, gangway towers, piping, maintenance access roadways and access ramps, wastewater collection and drainage and supporting utilities for handling liquid bulk shipments. The pipework would run along the jetty, over the existing seawall, to a connection point with the landside pipework.

g. The construction of lighting infrastructure, utilities (electrical systems, firewater systems including pumps and pipework, communications systems, security systems) and drainage.

h. A capital dredge of approximately 4,000m^3 (based on the latest available site-specific geotechnical and geophysical information) would be required to ensure accessibility and safe mooring for vessels on the berth at all states of the tide. The required dredge depth would be approximately 14.5m below Chart Datum. As noted at **Paragraph 2.4.3**, the dredge will be located in accordance with the co-ordinates for it provided in a Condition of the Deemed Marine Licence which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]**.

i. The dredged berth pocket would be optimised to include side slopes to ensure its stability, and the dredged arisings would be disposed of at licensed sites within the estuary.

j. Periodic maintenance dredging may be required and would be undertaken alongside existing maintenance dredge operations undertaken at the Port by the Applicant.

k. A landside jetty access ramp, up to 105m in length and 6.5 wide, would connect the jetty approach trestle to the jetty access road. The jetty access ramp would be supported by up to 14 piles with a maximum diameter of 1.2m. The jetty access ramp would include a turnout ramp which would provide vehicle access to the northern side of the jetty; this is required for maintenance and emergency works.

l. Replacement of up to 25m of the existing flood defence (sea wall) to facilitate the new jetty access ramp including raising the flood defence level directly under the jetty access ramp to +7m Ordnance Datum.

m. Infrastructure to enable the Environment Agency ongoing access to the sea wall for flood defence monitoring and maintenance activities. This will include a dedicated flood defence access ramp providing access onto the existing flood defence road. This ramp will connect to the jetty access road and will involve a bridge across the watercourse. The ramp will be a concrete slab supported by up to 10 piles with a maximum diameter of 1.2m.

2.4.23 **Table 2-3** below provides further details of the structures and buildings that would be constructed as part of Work No. 1, expanding where relevant on the bullet point list provided above. The details in **Table 2-3**, including dimensions, locations, construction type and colour shown in the table, are all indicative:

Table 2-3: Terminal – Proposed Structures and Buildings (Indicative details)

Structures/ Buildings	No. of Units	Indicative Dimensions			Indicative Location	Indicative Construction Type, Materials and Finishes
		Length (m)	Width (m)	Height (m)		
Jetty Head Loading Platform	1	40	31	From seabed level to between +11.5 and +13.5 Chart Datum	-	Exposed reinforced concrete jetty deck supported by piles, grey. Piles will be black painted or brown (natural rust coloured) steel piles.
Breasting Dolphin 1	1	31	16	From seabed level to +10.5 Chart Datum	-	Exposed reinforced concrete deck supported by piles, grey. Piles will be black painted or brown (natural rust coloured) steel piles.
Breasting Dolphin 2	1	21	31	From seabed level to between +11.5 and +13.5 Chart Datum	-	Exposed reinforced concrete deck supported by piles, grey. Piles will be black painted or brown (natural rust coloured) steel piles.

Structures/ Buildings	No. of Units	Indicative Dimensions			Indicative Location	Indicative Construction Type, Materials and Finishes
		Length (m)	Width (m)	Height (m)		
Mooring Dolphins	8	13	15	From seabed level to +10.5 Chart Datum	-	Exposed reinforced concrete deck supported by piles, grey. Unpainted aluminum or galvanized steel (grey) walkways. Piles will be black painted or brown (natural rust coloured) steel piles.
Approach Jetty	1	1200	14 typically (up to 17 at roadway passing places and 27 at Jetty Operations Building)	From seabed level to between +11.5 and +13.5 Chart Datum	-	Exposed reinforced concrete deck supported by piles, grey. Open galvanized steel or Glass-Reinforced-Plastic ("GRP") mesh flooring under pipe racks. Piles will be black painted or brown (natural rust coloured) steel piles.
Gangway Towers	2	-	-	14.5 above deck level	One on each of the Breasting Dolphins	Galvanised steel/ unpainted aluminium.
Marine Loading Arms	7	-	-	20 above deck level	Jetty head loading platform	Galvanised/painted steel, grey/silver.
Fire-fighting Towers	2	-	-	20 above deck level	One on each of the Breasting Dolphins	Galvanised/painted steel, red.
Jetty Head Building	1	16.5	4.5	4 above deck level	Breasting dolphin 2	Prefabricated fiberglass, pale grey.
Toxic Refuge Shelter with attached office, WC and external shower	1	2	8	4 above deck level	Jetty head loading platform	Prefabricated fiberglass, pale grey.

Structures/ Buildings	No. of Units	Indicative Dimensions			Indicative Location	Indicative Construction Type, Materials and Finishes
		Length (m)	Width (m)	Height (m)		
Jetty Operations Building	1	22	10	4 above deck level	Approach jetty	Prefabricated portacabin, pale grey.
Jetty Access Ramp	1	105	6.5	From seabed level to +13.5 Chart Datum	-	Concrete slabs supported by up to 14 piles (1.2m diameter). Piles will be black painted or brown (natural rust coloured) steel piles.
Flood Defence Access Ramp	1	52	6.5	Up to +8 Ordnance Datum	-	Concrete slabs supported by up to ten piles (1.2m diameter). Piles will be black painted or brown (natural rust coloured) steel piles. Ground bearing slab turning area with retaining wall.
Flood Defence Raising	1	25	4	Up to +7 Ordnance Datum	-	L-section reinforced concrete structure built on top of the existing embankment.

2.4.24 Utility/service connections for the Terminal are detailed in the **Utilities Statement [TR030008/APP/7.4]** and summarised in **Table 2-4.**

Table 2-4: Terminal Utility/Service Connections

Utility/Service	Connection
Power	The Terminal will be supplied with electricity from a separate connection located in Laporte Road which will connect to an electrical substation on the East Site for onward transmission to the Terminal.
Potable water	A new potable water connection from Laporte Road to the Terminal serving the control buildings and welfare facilities at the jetty head.
Telecommunications	A data and telecommunications connection for the Terminal to be provided from the West Site via the Pipeline Corridor to the East Site and then onto the Terminal.

Landside Infrastructure (Associated Development – Permanent Works)

2.4.25 The main elements of landside infrastructure[1] associated with the Project for which consent is sought under this application for development consent would consist of a jetty access road and the infrastructure, including the buildings, plant and pipelines, necessary to import the ammonia from the jetty, to store the ammonia on the East Site and then to convert that ammonia into green hydrogen at the East and West Sites. The green hydrogen production facility would be the first user of the NSIP.

2.4.26 The permanent landside infrastructure would consist of a number of components, comprising **Work No. 2** to **Work No. 7**, as detailed below. Unlike **Work No. 1**, the landside infrastructure is expected to be subject to extensive further design development within the ambit of the spatial parameters described for these works at **Paragraphs 2.4.12** and **2.4.15**. The descriptions below also include brief descriptions of temporary uses of these work areas during the construction phase.

Pipe-Rack and Jetty Access Road (Work No. 2)

2.4.27 These works include the construction of a 'jetty access road', a pipe-rack and associated buildings and plant, including:

a. The construction of a private road (the 'jetty access road') for operational access to the Terminal (Work No. 1) and maintenance access to the pipelines, including the formation of a new access on Laporte Road.

b. The construction of above-ground pipe-racks supporting pipelines and utilities, linking pipelines and utilities which form part of the Terminal (Work No. 1) to pipelines and utilities in the East Site (Work No. 3).

c. The construction of a gated access control point with security access gates at the entrance to Laporte Road, a security building and parking provision.

d. The construction of a power distribution building to house high-voltage switchgear which would have a separate connection from Northern Powergrid network located in Laporte Road. The building will contain electrical equipment to supply power to facilities on the jetty and parking provision would be provided. This building is sized to enable a shore power equipment (frequency converter) to be added in the future.

e. The construction of lighting infrastructure, utilities (electrical systems, communications systems, security systems, potable water supply), drainage, culverts, traffic control systems, gates and fencing.

[1] Noting that Work No 1. (the NSIP) includes an element of landside works, primarily the ramps associated with the jetty

2.4.28 The pipe-rack would support the ammonia (NH_3) pipelines from the Terminal (Work No. 1) to the East Site – Ammonia Storage area (Work No. 3) to deliver refrigerated liquid ammonia to the ammonia storage tank (Work No. 3-A). The pipelines would be insulated and have emergency shutdown valves, thermal relief, expansion loops, and leak detection as required. The pipe-rack would also include power, communications and utilities. The pipe-rack structure would run along the western side of the jetty access road, which would allow maintenance access to the pipelines from the access road as required.

2.4.29 A corridor adjacent to the ammonia pipelines to the west has been reserved for future pipelines for transfer of other liquid bulk products from the Terminal to the public highway. Separate applications for these works would be submitted as required. The width of this corridor is also required to provide a working site for the construction of the jetty access road and to enable the perimeter fencing to the east of the jetty access road to be installed.

2.4.30 The construction of the jetty access road and pipe rack corridor would lead to tree loss from the Long Strip woodland TPO area - this is considered in **Chapter 8: Nature Conservation (Terrestrial Ecology)** and **Chapter 13: Landscape and Visual [TR030008/APP/6.2]**. The tree loss has been minimised by routing the jetty access road and the pipe rack corridor through the western side of the Long Strip and by routing the southern end of the jetty access road through the East Site.

2.4.31 The routing of the jetty access road is considered further in **Chapter 3: Need and Alternatives [TR030008/APP/6.2]**. For these works and the approach ramp to the jetty (included as part of Work No. 1), it is predicted that approximately 0.64ha of the heavily wooded area would need to be cleared. The removal of trees from the Long Strip TPO woodland (and the removal of hedgerows across the site as a whole) is controlled by an Article of the **draft DCO [TR030008/APP/2.1]** and the **Plan of Potentially Affected Hedgerows and Trees Subject to Preservation Orders [TR030008/APP/4.9]**. An **Arboricultural Impact Assessment** and **Tree Constraints Plan** is provided in **Appendix 8.F [TR030008/APP/6.4]**.

2.4.32 The drainage of the jetty access road would be developed through detailed design; however, it is likely that three new culverts would be constructed as part of Work No. 2. These three culverts would likely be required as follows:

a. Where the new jetty access road crosses an existing road side ditch near the landside access road junction with Laporte Road; in this location the conveyance within the ditch would be maintained through the provision of a precast concrete piped culvert.

b. Where the new jetty access road crosses an existing field ditch mid-way along its length; in this location the conveyance within the ditch would be maintained through the provision of a precast concrete piped culvert.

c. Where the new jetty access road runs parallel with the existing field ditch; it is expected that the section of ditch to the south of the access road crossing would be retained as a natural channel although its profile would be modified to improve its hydraulic characteristics. The section of ditch to the north of the access road crossing would be hydraulically enhanced through the provision of a concrete lined channel given its close proximity to the proposed infrastructure.

2.4.33 The approach to drainage across the proposed operational works on the Site is provided in the **Drainage Strategy Appendix 18.B [TR030008/APP/6.4]** of this ES.

2.4.34 The preliminary design of the pipe-rack and jetty access road is shown on **Figure 2.5 [TR030008/APP/6.3],** in **Illustrative Layouts [TR030008/APP/4.3]** and **Illustrative Sections and Elevations [TR030008/APP/4.4]**.

2.4.35 **Table 2-5** provides indicative details of the main buildings and structures that would be constructed during Work No. 2, such as approximate dimensions and likely construction type and colour. No indicative details are provided for smaller elements of infrastructure such as gates, fences or lighting columns.

Table 2-5: Jetty Access Road – Proposed Buildings and Structures (Indicative details)

Building/ Structure	No. of Units	Indicative Dimensions			Indicative Construction Type, Materials and Finishes
		Length (m)	Width (m)	Height (m)	
Jetty access road	1	375	5-7 (excluding passing bays)	Up to +5 Ordnance Datum	Suitable fill and likely asphalt surface or concrete pavement
Security building	1	5	2	3 above Finished Ground Level	Prefabricated portacabin building, pale grey
Power distribution building	1	20	11	4.5 above Finished Ground Level	Prefabricated portacabin building, pale grey/ dark green

East Site (Work Nos. 3 and 5)

2.4.36 The East Site would comprise an ammonia storage facility (Work No. 3, including Work No. 3a) and a hydrogen production facility supporting up to three hydrogen production units for the production of hydrogen from ammonia (Work No. 5 including 5a). The two parts of the East Site would be linked by pipelines through a culvert under Laporte Road (Work No. 4, described below).

2.4.37 The East Site would be linked to the Terminal (Work No. 1) through the jetty access road and ammonia pipelines (which form part of Work No. 2) as well as communications and utilities links as described above.

2.4.38 Offloaded refrigerated liquid ammonia from the Terminal would be transferred via the pipelines to the ammonia storage tank on the East Site (Work No. 3-A). The storage facility would include a refrigeration (boil-off gas) system, storage flare for emergency or infrequent operational use and supply pumps for the hydrogen production units.

2.4.39 In the hydrogen production units, the liquid ammonia would be split into hydrogen and nitrogen (N) (nitrogen makes up 78% of the composition of ambient air). The core of the process is a catalytic bed. This reaction is endothermic i.e. it requires heat to take place, so the catalytic bed sits within a furnace, which would be fired using natural gas. The furnace output capacity would be approximately 30MW during the initial phases of development (operation of the first three hydrogen production units) plus a similar output for the future phases (full operation of six hydrogen production units in total). It is anticipated that this process could be further decarbonised in future by switching to low carbon fuels, potentially including green or low carbon hydrogen or biomethane.

2.4.40 The East Site – Ammonia Storage area (Work No. 3) would include the construction of the following components:

a. An ammonia storage tank in which refrigerated liquid ammonia would be stored at nearly atmospheric pressure and minus 33°C and which would include a boil-off gas processing unit, ammonia tank flare stack, pumps and associated plant and infrastructure (Work No. 3a).

b. Piling and foundations to support the construction of the ammonia storage tank, pipe-racks and other equipment and infrastructure.

c. Ancillary buildings and works, including welfare building, power distribution building and process instrumentation building and process and utility equipment, including a fire water tank and an instrument air receiver vessel.

d. Pipelines, pipes and cables (above and below ground) and pipe-racks and cable racks (above ground) between operational works and extensions of those parts of the pipelines, cables and related structures in Work Nos. 4 and 6 which link to elements within the Work No. 3.

e. Permanent road accesses from the public highway to the Site and to the jetty access road (Work No. 2).

f. Internal site roads, hard standing and parking areas.

g. Drainage system, sumps and pumps and a water retention pond.

h. Utilities, transformers, lighting infrastructure.

i. Fencing and gates.

2.4.41 Initially, no hydrogen production units would be constructed on the East Site – Hydrogen Production Facility (Work No. 5) in Phase 1 of the Project (see **Paragraphs 2.4.78** onwards for definitions of Phases), with hydrogen production units (up to three) at this location being added in future phases of development (Phases 3-6). One flare stack would be required per hydrogen production unit, therefore up to three flare stacks would be required on the East Site in addition to the Ammonia tank flare stack (part of Work No. 3a). Each flare stack would be

fitted with a shroud to minimise visibility of the pilot light. Use of the flares would be exceptional i.e. for emergency use only and during start up and shut down during catalyst replacement (every 2-3 years).

2.4.42 The East Site – Hydrogen Production Facility (Work No. 5) would include the construction, in Phases 3-6, of the following components:

a. Up to three hydrogen production units, that convert ammonia to produce the hydrogen, each including fired heater, fired heater flue gas stack (one per unit), flare stack (one per unit), heat exchangers, compressor buildings and associated structures, process equipment, pipe-racks, pipelines, pipes, cable-racks, cables and other conducting media (Work No. 5a).

b. Piling and foundations to support the construction of the hydrogen production units and other infrastructure.

c. Ancillary buildings and works, including a process control building, power distribution buildings, process instrumentation buildings and analyser shelters and process and utility equipment, including a firewater tank and an instrument air receiver vessel.

d. Pipelines, pipes and cables (above and below ground) and pipe racks and cable racks (above ground) between operational works and extensions of those parts of the pipelines, cables and related structures in Work Nos. 4 which link to elements within Work No. 5.

e. Permanent road accesses from the public highway to the Site and to the jetty access road (Work No. 2).

f. Internal site roads, hard standing and parking areas.

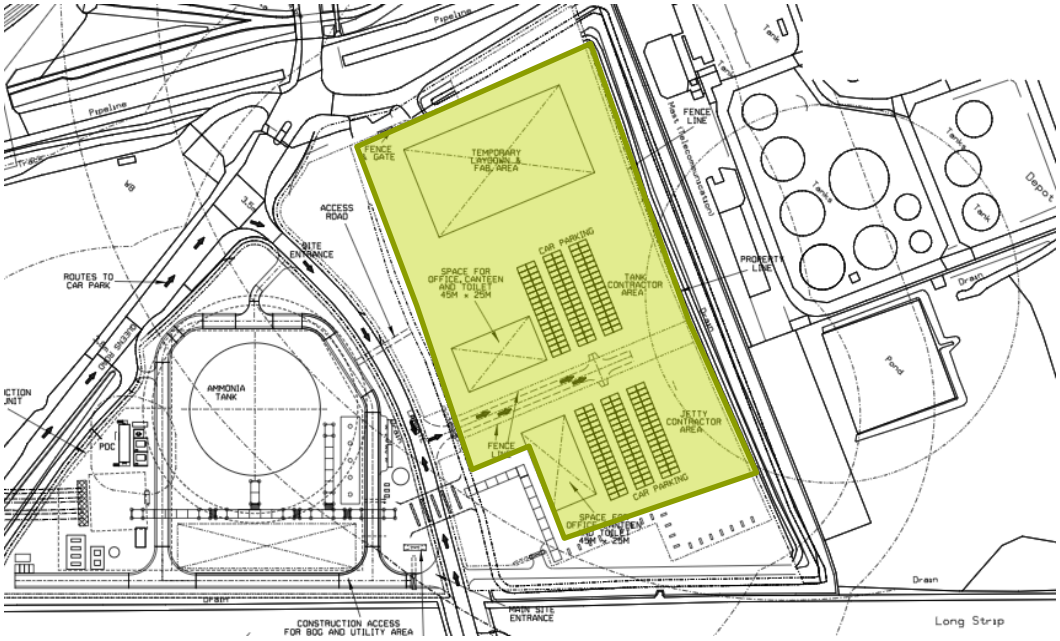
g. Drainage system, sumps and pumps and a water retention pond.

h. Utilities, transformers, lighting infrastructure.

i. Fencing and gates.

2.4.43 During Phase 1 of the Project, the area of Work No. 5 would be used for contractor and subcontractor cabins, laydown, warehouse storage and car parking related to the ammonia tank and jetty contractors. An illustrative layout for this is shown in **Plate 2-1**.

Plate 2-1: Illustrative layout of area of Work No. 5 during temporary use



2.4.44 The preliminary design of the East Site – Ammonia Storage and the East Site – Hydrogen Production Facility is shown in **Figure 2.5 [TR030008/APP/6.3],** in **Illustrative Layouts [TR030008/APP/4.3]** and **Illustrative Sections and Elevations [TR030008/APP/4.4]**.

2.4.45 **Table 2-6** provides indicative details for the main buildings and other structures that would be constructed under Work Nos. 3, 3a, 5 and 5a, such as approximate dimensions (heights are above FGL), likely construction type and indicative colours.

Table 2-6: East Site – Main Buildings and Structures (Indicative details)

Building/Structure	Indicative Dimensions			Indicative Construction Type	No. of Units	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
East Site – Ammonia Storage area (Work No. 3a)						
Ammonia Tank	70 (dia.)		38-45	Steel or concrete	1	White
Ammonia Tank Flare Stack	4	4	55-65	Steel framed open structure	1	Window grey
East Site – Ammonia Storage area (Work No. 3, other than Work No. 3a)						

Building/Structure	Indicative Dimensions			Indicative Construction Type	No. of Units	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
Main Buildings						
Welfare Building	4	8	4	Pre-fab Module	1	Signal grey
Power Distribution Building	25	6	7	Pre-fab Module	1	Signal grey
Process Instrumentation Building	15	6	4	Pre-fab Module	1	Signal grey
Firewater tank	14 (dia.)		12	Steel	1	White
Instrument Air Receiver vessel	5.5 (dia.)		20	Steel	1	White
East Site – Hydrogen Production Facility (Work No 5a)						
Hydrogen Production Unit compressor building	14	18	15	Steel framed structure	3	Signal grey
Hydrogen production unit fired heater and associated structures	13	8	27.6	Steel framed open structure	3	Window grey RAL7040
Hydrogen production unit fired heater flue gas stack	-	-	30.5	Steel framed open structure	3	Window grey RAL7040
Hydrogen production unit flare stack	-	-	37-45	Steel	3	Window grey RAL7040
East Site – Hydrogen Production Facility (Work Nos 5, other than Work No. 5a)						
Process Control Building	35	20	4.5	Reinforced concrete building or steel clad	1	Signal grey
Power Distribution Building	20	6	4	Pre-fab Module	3	Signal grey
Process Instrumentation Building	15	6	4	Pre-fab Module	3	Signal grey RAL7004

Building/Structure	Indicative Dimensions			Indicative Construction Type	No. of Units	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
Analyzer Shelter	5	5	4	Pre-fab Module	12	Signal grey RAL7004
Firewater Tank	14 (dia.)		12	Steel	1	White
Instrument Air Receiver Vessel	5.5 (dia.)		20	Steel	1	White

2.4.46 Utility and service connections for both parts of the East Site are detailed in the **Utilities Statement [TR030008/APP/7.4]** and summarised in **Table 2-7.**

Table 2-7: East Site Utility/Service Connections

Utility/Service	Connection
Nitrogen	The East Site would receive nitrogen that is generated at the West Site via a connection pipeline in the Pipeline Corridor.
Natural gas	Natural gas would be provided by Cadent Gas from a tie-in to a gas main running from an existing gas governor compound on Laporte Road, which is expected to be installed by Cadent Gas.
Power	The Project requires a power feed of approximately 90MW for landside works. The East Site would be supplied with electricity via a connection to the Immingham substation from the West Site via the Pipeline Corridor, which would be provided by Northern Power Grid. The voltage level of the supply is approximately 132kV.
Potable water	A connection to the local water mains network would be made for personnel welfare use only, via a connection into the existing potable water main running the length of Laporte Road. The local provider is Anglian Water.
Non-Potable Water	A connection to an existing non-potable water main running the length of Laporte Road would be required for cooling water for the Hydrogen Production Facility. The local provider is Anglian Water.
Firewater	A firewater system within the Site Boundary is required and would be serviced from an on-site fire water tank, approximately 12m high and 14m in diameter, fed from the non-potable water connection. An allowance would be made for the retention of firewater (contaminated water from firefighting). It is anticipated that this would be a retention basin sized for the maximum fire case with allowance for storm conditions. This basin would also be able to act as a hold up for chemical spills and arrangements would be made to sewerage provided to collect spills.

Utility/Service	Connection
Wastewater	A site-wide drainage system would be required for surface run-off and would include attenuation storage to mitigate the impact of introducing impermeable surfaces. Refer to the **Drainage Strategy [TR030008/APP/6.4]** for further details on the management of wastewater and its disposal from the Site.

Laporte Road Culvert (Work No. 4)

2.4.47 The Laporte Road culvert involves the construction in Phase 1 of an underground culvert, containing pipelines and cables and other conducting media, under Laporte Road, to link infrastructure in the East Site – Ammonia Storage area (Work No. 3) to the East Site – Hydrogen Production Facility (Work No. 5). The works would include related surface works, excavations, installation of the works, back-filling and making good to the highway.

Pipeline Corridor (Work No. 6)

2.4.48 The Pipeline Corridor would contain a series of underground pipelines, linking the East and West Sites. These are expected to be parallel pipelines and would be installed underground at an expected depth of 5-10m below the existing ground level. They would be constructed using Horizontal Directional Drilling ("HDD") or micro tunnelling techniques, both of which would minimise surface disturbance. The pipelines would include:

a. A hydrogen pipeline to allow the export of hydrogen from hydrogen production units installed on the East Site to the liquefier(s) installed on the West Site.

e. Two Ammonia pipelines, with leak detection technology, to allow the export of ammonia from the storage tank installed on the East Site to the hydrogen production units installed on the West Site.

c. A nitrogen pipeline to supply nitrogen from a generator on the West Site for safety related purposes such as line purging or blanketing.

n. A cathodic protection system, to be installed to protect the pipeline(s) from corrosion.

o. A cooling water make up supply line from the tie in location near the East Site

p. Utility connections in the Pipeline Corridor for the supply of communications links and electricity between the East and West Sites. It is possible that the utility connections could be provided by constructing these from the surface using standard techniques for utilities works (trench excavation and backfill).

2.4.49 The proposed Pipeline Corridor for the main group of pipelines is illustrated on **Figure 2.5 [TR030008/APP/6.3]**.

West Site (Work No. 7)

2.4.50 The West Site, Work No. 7, includes the following main elements:

a. West Site – Hydrogen Production and Liquefication (Phase 1) (Work No. 7a).

b. West Site – Hydrogen Production and Liquefication (Work No. 7b).

c. West Site – Liquid Hydrogen Storage and Trailer Filling Stations (Work No. 7c).

d. West Site – Gaseous Hydrogen Vehicle Refuelling and Trailer Filling Stations (Work No. 7d).

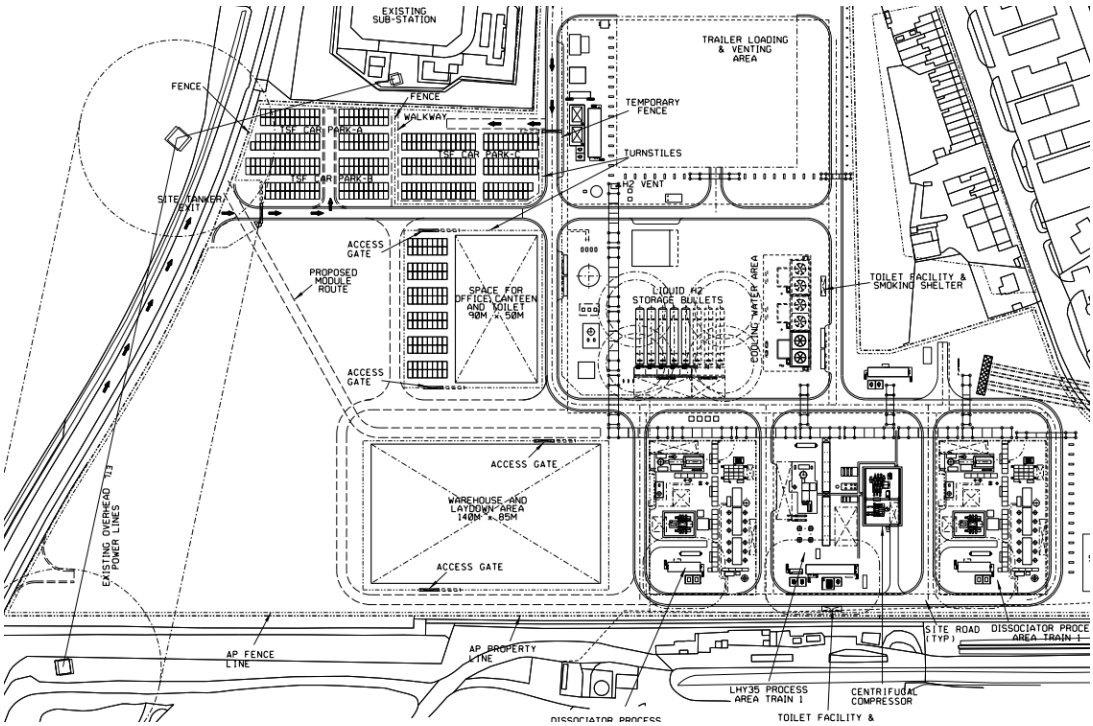
2.4.51 The West Site would comprise up to four hydrogen liquefiers (one in Work No. 7a and three in Work No. 7b) and vessels for the temporary storage of the liquid hydrogen (part of Work No. 7c). A site-wide cooling system is also required for the Project and the cooling towers would be installed on the West Site. In addition, the West Site would accommodate a control room and workshop building, warehouse, security and visitor building and other buildings associated with the operation of the facility, as well as liquid hydrogen storage and trailer filling stations (part of Work No. 7c) associated with the bulk distribution of the green hydrogen.

2.4.52 Initially two hydrogen production units would be constructed on the West Site in Phase 1, whilst one further unit would be added in Phase 2 of the Project as indicated in **Table 2-11**, making a total of six hydrogen production units across the West and East Sites when fully built out.

2.4.53 Access to the West Site is proposed via the construction of three new permanent entrances, two from Kings Road and the other from the A1173 – see **Street Works and Accesses Plan [TR030008/APP/4.6]** for further details. For details regarding operational traffic estimates see **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.

2.4.54 During the Phases 1-4 of the construction of the Project, an area within the West Site would be used for contractor and subcontractor cabins, laydown, warehouse storage and car parking related to the construction of the buildings and structures within the West Site. An indicative arrangement for Phase 1 is shown in **Plate 2-2.**

Plate 2-2: Illustrative layout of Work No. 7 during temporary use



2.4.55 **Table 2-8** provides indicative details of the buildings and structures that would be constructed under Work No. 7 such as the indicative dimensions, construction type and colour.

2.4.56 The preliminary design of the West Site is shown in **Figure 2.5 [TR030008/APP/6.3], Illustrative Layouts [TR030008/APP/4.3]** and **Illustrative Sections and Elevations [TR030008/APP/4.4]**.

Table 2-8: West Site Key Buildings and Infrastructure (Indicative details)

Building/Infrastructure Name	Indicative Dimensions			Indicative Construction Type	No. of Units (total)	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
West Site – Work No. 7a						
Hydrogen Production Unit Compressor Building	14	18	15	Steel framed structure	Up to 2	Signal grey RAL7004
Hydrogen production unit fired heater and associated structures	13	8	27.6	Steel framed open structure	Up to 2	Window grey RAL7040

Building/Infrastructure Name	Indicative Dimensions			Indicative Construction Type	No. of Units (total)	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
Hydrogen production unit fired heater flue gas stack	-	-	30.5	Steel framed open structure	Up to 2	Window grey RAL7040
Hydrogen production unit flare stack	-	-	37-45	Steel	Up to 2	Window grey RAL7040
Hydrogen Liquefier Unit Compressor Building	24	36	15	Steel framed structure	1	Signal grey RAL7004
Liquefier cold box	4	4	25	Steel	1	Pure white RAL9010
Liquefier H_2 flare stack and structure	3	3	40-45	Steel	1	Window grey RAL7040
West Site – Work No. 7b						
Hydrogen Production Unit Compressor Building	14	18	15	Steel framed structure	1	Signal grey RAL7004
Hydrogen production unit fired heater and associated structures	13	8	27.6	Steel framed open structure	1	Window grey RAL7040
Hydrogen production unit fired heater flue gas stack	-	-	30.5	Steel framed open structure	1	Window grey RAL7040
Hydrogen production unit flare stack	-	-	37-45	Steel	1	Window grey RAL7040
Hydrogen Liquefier Unit Compressor Building	24	36	15	Steel framed structure	Up to 3	Signal grey RAL7004
Liquefier cold box	4	4	25	Steel	Up to 3	Pure white RAL9010
Liquefier H_2 flare stack and structure	3	3	40-45	Steel	Up to 3	Window grey RAL7040

Building/Infrastructure Name	Indicative Dimensions			Indicative Construction Type	No. of Units (total)	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
West Site – Work No. 7c						
Hydrogen vent stack	3	3	40-45	Steel	1	Window grey RAL7040
West Site – Hydrogen Production Facility (Work No 7, other than Work No. 7a-7c)						
Control Room and Workshop Building	69	25	7	Reinforced concrete or steel clad	1	Signal grey RAL7004
Security & Visitor Building	20	15	4.5	Reinforced concrete or steel clad	1	Signal grey RAL7004
Contractor Building	18	12	4.5	Reinforced concrete or steel clad	1	Signal grey RAL7004
Warehouse	15	10	4.5	Prefabricated module	1	Signal grey RAL7004
Driver Administration Building	5	5	3.5	Prefabricated Module	1	Signal grey RAL7004
Safe Haven Building	5	10	4	Reinforced concrete or steel clad	1	Signal grey RAL7004
Electrical Substation and Metering Station	30	8	4.5	Prefabricated module	1	Signal grey RAL7004
Power Distribution Building	20-40	5.8	5	Prefabricated module	8	Signal grey RAL7004
Process instrumentation Building	12-15	2.5-6	4	Prefabricated module	7	Signal grey RAL7004
Analyser Building	3-13	3-7	2-5	Prefabricated module	15	Signal grey RAL7004
Cooling Tower	12	12	20	Steel framed and clad structure	Up to 6	Signal grey RAL7004

Building/Infrastructure Name	Indicative Dimensions			Indicative Construction Type	No. of Units (total)	Indicative Colour
	Length (m)	Width (m)	Height above FGL (m)			
Firewater Tank	14 (dia)		12	Steel	1	White
Instrument Air receiver vessel	4.5 (dia)		16	Steel	1	White
Other Buildings	undefined	undefined	6	undefined	undefined	undefined

2.4.57 Utility/service connections for the West Site are detailed in **Utilities Statement [TR030008/APP/7.4]** summarised in **Table 2-9.**

Table 2-9: West Site Utility / Service Connections

Utility/Service	Connection
Nitrogen	Nitrogen would be generated on the West Site and used across all operational areas to purge pipelines, pipes and vessels and create inert atmospheres within the same.
Natural gas	A new intermediate gas connection to the West Site via a tie-in from the existing main intermediate pressure underground gas line beneath Queens Road would be required. Gas will be distributed internally across the West Site and via the Pipeline Corridor to the East Site – Ammonia Storage area.
Power	The Project requires a power feed of approximately 90MW for landside works. The power feed for the landside works would be provided by Northern Powergrid to the West Site and internally distributed across the West Site and via the Pipeline Corridor to the East Site. Modifications to Immingham substation adjacent to the West Site would be required to accommodate a new 132kV connection to 132kV/33kV transformers on the West Site
Potable water	A connection to the local water mains network would be made. The local provider is Anglian Water.
Cooling water	A site-wide cooling loop would be required. Make-up water will be supplied from a tie in point close to the East Site and routed through the Pipeline Corridor.

Utility/Service	Connection
Firewater	A firewater system within the Site Boundary is required and would be serviced from on on-site fire water tank approximately 12m high and 14m in diameter. An allowance would be made for the retention of firewater (contaminated water from firefighting). It is anticipated that this would be a retention basin sized for the maximum fire case with allowance for storm conditions. This basin would also be able to act as a hold up for chemical spills and arrangements would be made to sewerage provided to collect spills.
Wastewater	A site-wide drainage system would be required for surface run-off and would include attenuation storage to mitigate the impact of introducing impermeable surfaces. Refer to the **Drainage Strategy [TR030008/APP/6.4]** for further details regarding the management of wastewater and its disposal from Site.

Water and Sewerage

2.4.58 The operational Project is estimated to require approximately 3,640m^3/day of non-potable water to support the hydrogen production facility. The non-potable supply is primarily required to provide cooling water make-up.

2.4.59 The hydrogen production facility would also require non-potable water for periodic use including fire water storage and utility stations but these would be small quantities and would not impact the overall water demand.

2.4.60 Agreement has been reached in principle with Anglian Water for the provision of non-potable water to the required standards suitable for use in the site cooling towers for the hydrogen production facility, sufficient for the full project (Phases 1-6). This water is to be transferred to the site from an existing Anglian Water resource. The use of non-potable water for this application will reduce the pressure of the Project on an already water stressed Water Resource zone within the UK. A connection to an existing non-potable water main running the length of Laporte Road would be required (see also the **Utilities Statement, [TR030008/APP/7.7]**).

2.4.61 The operational Project would also require a limited potable water supply for offices (including fire sprinkler systems), welfare facilities, steam boiler and site safety showers. The potable supply is expected to be drawn from the existing mains water supply through a connection in Kings Road (for West Site **Work No. 7**), Laporte Road (for East Sites and jetty, **Work Nos. 1**, **3** and **5**) (see the **Utilities Statement**, **[TR030008/APP/7.7]**). The potable supply would be sized by Anglian Water based on number of future users and subject to a separate agreement (from the non-potable supply) with the company.

2.4.62 Water supply and the potential for impacts on existing and future users is considered further in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2].**

2.4.63 Domestic sewer connections would be required for occupied buildings throughout the Site. The sewerage at the Terminal and at the jetty access road security building would be removed via road tanker and no new sewerage connections are envisaged.

2.4.64 Temporary potable water and sewerage connections would also be required during construction of the Project as detailed in **Section 2.6**.

Landscape and Biodiversity

2.4.65 An **Outline Landscaping and Ecology Management Plan** ("LEMP") **[TR030008/APP/6.9]** has been prepared. This plan sets out the measures which will be taken relating to landscape and biodiversity to enhance the operational design. Implementation of the proposed measures would be secured by a Requirement of the **draft DCO [TR030008/APP/2.1]**.

2.4.66 A **Woodland Compensation Strategy [TR030008/APP/6.8]** has been prepared. This strategy sets out the approach which will be used to compensate for the tree loss from the Long Strip woodland. The approach is to provide compensatory tree planting, in accordance with NELC policy, on a defined area within ABP's wider Port of Immingham estate. Approval of the final strategy and its implementation is secured by a Requirement of the **draft DCO** [**TR030008/APP/2.1**].

Fencing and Gates

2.4.67 Secure boundary fencing, such as paladin (or similar) fencing, would be provided on the Terminal (Work No.1), the corridor for pipe-rack and jetty access road (Work No. 2), the East Site (Work No. 3 and Work No. 5) and the West Site (Work No. 7). The Terminal and the corridor for the pipe-rack and jetty access road will be incorporated into the existing Port of Immingham's International Ship and Port Facility Security ("ISPS") boundary fence-line. The boundary fencing will comply with the minimum ISPS requirements and any updated security procedures will be incorporated into an update to the Port Facility Security Plan ("PFSP"). This would include the use of access control systems to manage people and vehicle access to each site. Close circuit television ("CCTV") and other security measures, including intruder alarms, would also be installed.

2.4.68 Offsets for security clearance from fencing and structures (including the hydrogen production facilities and the jetty access road) are required and are allowed for within the areas for the Works which are spatially defined on the **Works Plans [TR030008/APP/4.2]**. A "clear zone" would be established with a minimum 2.0m either side of the protective perimeter barrier. The clear zone would be kept free of any objects (saplings, weeds, overhanging tree branches, stored materials etc) that could possibly damage the perimeter fencing or facilitate unauthorised entry.

External Lighting

2.4.69 **Appendix 2.B** sets out a **Lighting Assessment Report** for the DCO Application **[TR030008/APP/6.4]**. Before any permanent lighting is installed, a detailed lighting scheme for the relevant landside lighting infrastructure would be submitted to the local planning authority for approval under a Requirement of the **draft DCO [TR030008/APP/2.1]**. and, in respect of the operational marine infrastructure lighting requirements, it is anticipated that a separate lighting scheme would be prepared in consultation with Humber Estuary Services.

2.4.70 The external lighting scheme for the landside infrastructure will be designed in accordance with relevant standards, including the Guidance Notes for the Reduction of Obtrusive Light (2020) published by the Institute of Lighting Engineers and/or Chartered Buildings Services Engineers ("CIBSE") requirements, as appropriate.

2.4.71 The external lighting scheme for the marine infrastructure will be designed to ensure that there is no interference with observation of navigation marks, buoys, and ships' navigation lights, nor affecting the night vision of crew members. The jetty structure would be marked with navigation lights. The current proposal is to use two fixed red lights, mounted vertically 3m apart, with the lower light 3m above the structure. The navigation lights would have a nominal range of five nautical miles. It is also proposed to mark the outer mooring dolphins and the outer breasting dolphins (i.e. four pairs of lights in total).

Flood Risk and Drainage

2.4.72 All sources of flood risk to and from the Project, including the impact of a changing climate on flood risk, have been assessed throughout the design development of the Project.

2.4.73 A surface water drainage system for the terrestrial parts of the Site has been designed which would intercept and attenuate all runoff generated by the Site to be conveyed to attenuation ponds prior to discharging to nearby surface watercourses. The drainage design includes the appropriate allowances for climate change. The discharge rates would be restricted to site greenfield rates ensuring no detriment with regard to flood risk.

2.4.74 The process of assessing the risk of flooding is set out in **Appendix 18.A Flood Risk Assessment [TR030008/APP/6.4]** and within **Chapter 18: Water Use Water Quality,Coastal Protection, Flood Risk & Drainage [TR030008/APP/6.2]**, whilst the drainage strategy for the Project is set out in **Appendix 18.B Drainage Strategy [TR030008/APP/6.4]**.

Emissions to Air and Odour Risk

2.4.75 Information on emissions to air and odour risk arising from the Project is provided in **Chapter 6: Air Quality [TR030008/APP/6.2]**.

Waste

2.4.76 Details regarding the disposal of solid waste are set out in **Chapter 20: Materials and Waste [TR030008/APP/6.2]**.

Process Safety and Hazard Management

2.4.77 Process safety and hazard management are addressed in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

Construction and Operational Phasing of the Project

2.4.78 There would be a phased approach to the construction of the Project as illustrated in **Figure 2.6 [TR030008/APP/6.3]**. Under this scenario, the construction of the Terminal and first phase of the green hydrogen production facility (including works on both the East Site and West Site as outlined above and described below) would comprise the first phase of development, which, subject to securing the relevant consents, is likely to start in early 2025 and last for between two and a half and three years.

2.4.79 Following completion of the first phase of the construction, a further five phases of the hydrogen production facility would be constructed incrementally to increase the processing capacity as the market for green hydrogen increases. There would be six phases of development in total (see **Table 2-9**).

2.4.80 For the purposes of this ES, a development scenario has been defined based on a six-phase construction timeline through to full completion of all phases over an indicative eleven-year period. This programme duration is likely to be a worst case in EIA terms. This is because although market demand could accelerate the programme for Phases 2-6, Phase 1 would always represent the peak of construction, irrespective of the subsequent programme for Phases 2 onwards. Phase 1 includes the construction of the permanent works Work No.s 1, 2, 4, and 6 in their entirety and substantive elements of Work No.s 3, 5 and 7, as well as the use of temporary construction areas at Work No. 8 and 9. An indicative construction phasing timeline is illustrated in **Table 2-10** and assumes that each phase of the Associated Development would become operational following its construction.

Table 2-10: Indicative Construction Phasing Timeline for the Project

Phase	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Phase 1											
Phase 2											
Phase 3											
Phase 4											
Phase 5											
Phase 6											

2.4.81 The start of construction of Phase 2 (here shown in Year 4), would depend on a number of factors including market demands for hydrogen at that point in time, whilst the timing of subsequent phases would be subject to the same tests. Construction of Phases 2 – 6 may take up to eight years.

2.4.82 Each phase of the Project's development would involve construction of different buildings and infrastructure within each area of the Site, as presented in **Table 2-11**.

Table 2-11: Principal Buildings and Infrastructure within the Site by Phase

Phase	Terminal (Work No. 1)	Pipeline Corridors (Works Nos 2, 4, 6)	East Site (Work Nos 3, 5)	West Site (Work No. 7)	Temporary Construction Areas (Work no. 8, 9 and temporary use of other sites)
Phase 1 **Construction:** **Y 1 – Y3**	Jetty structure and Jetty topside infrastructure, including pipework for ammonia and other liquid bulks Jetty access ramp Flood defence access ramp and flood defence replacement	Piperack and NH_3 pipeline from the jetty Jetty access road H_2, NH_3 and Natural Gas pipelines and utilities between East and West Site Culvert including pipework, utilities and cabling linking the two parts of the East Site	NH_3 tank Internal access roads, drainage and utilities Temporary construction area	Two hydrogen production units One liquefier Tanker loading bays and hydrogen storage Trailer filling Station Control room and workshop building Other supporting building and facilities as listed in **Table 2-8** Internal access roads, drainage and utilities	Queens Road Temporary Construction Area for Air Products and contractor offices (Work No 8) Laporte Road Temporary Construction Area for material laydown and storage (Work No. 9) East Site – Hydrogen Production Facility for contractor offices, car parking, laydown storage in addition to a possible concrete batching plant and pile welding facility West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking

Phase	Terminal (Work No. 1)	Pipeline Corridors (Works Nos 2, 4, 6)	East Site (Work Nos 3, 5)	West Site (Work No. 7)	Temporary Construction Areas (Work no. 8, 9 and temporary use of other sites)
Phase 2 Construction: Y4 – Y5	-	-	-	One hydrogen production unit One liquefier Hydrogen Refuelling Station and compressor	West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking
Phase 3 Construction: Y6 – Y7	-	-	One hydrogen production unit	One liquefier	West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking East Site – Hydrogen Production Facility for contractor offices, car parking, laydown storage
Phase 4 Construction: Y8 – Y9	-	-	-	One liquefier	West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking
Phase 5 Construction: Y9 – Y10	-	-	One hydrogen production unit	-	West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking East Site – Hydrogen Production Facility for

Phase	Terminal (Work No. 1)	Pipeline Corridors (Works Nos 2, 4, 6)	East Site (Work Nos 3, 5)	West Site (Work No. 7)	Temporary Construction Areas (Work no. 8, 9 and temporary use of other sites)
					contractor offices, car parking, laydown storage
Phase 6 Construction: Y10 – Y11	-	-	One hydrogen production unit	-	West Site – for contractor and subcontractor cabins, laydown and warehouse storage and car parking

2.5 Construction

Construction Activities

2.5.1 The approach to Project construction described in the following sections is indicative. However, it is considered to be representative of a reasonable worst-case scenario of how the Project would be implemented and the description provided here has been used as the basis of the EIA for the construction phase. The approach to construction would be further refined and finalised during the detailed design phase. The definition of "construct" in the **draft DCO [TR030008/APP/2.1]** is stated to include execution, placing, altering, replacing, relaying and removal, and those activities have been taken into account in the assessment contained in this Environmental Statement.

2.5.2 The main aspects of constructing the Project's marine and landside infrastructure components are detailed in the following sections. Construction of the Project is anticipated to require the following activities which are detailed further below:

a. Installation and use of temporary site facilities and laydown areas comprising fencing, vehicle parking, material storage areas, fuel storage bunds and worksites.

b. Installation and use of temporary accesses and haul routes, vegetation clearance and soil removal.

c. Transportation of materials and labour throughout the construction phase.

d. Use of a concrete batching plant.

e. Ground works (including remediation as required).

f. Piling.

g. Infrastructure construction activities, routing or services and utilities.

2.5.3 The Site Boundary, shown in **Figure 1.1 [TR030008/APP/6.3]** is sized to ensure that sufficient space is included for temporary roads, temporary working and storage areas, and provision of site facilities and laydown areas to be used during the construction of the Project.

2.5.4 It is expected that certain works (referred to as early works) would need to be undertaken ahead of the main marine and landside construction works to allow these works to proceed, and to optimise the overall delivery programme of the Project. Early works are expected to comprise works associated with establishment of construction compounds, including construction accesses and haul roads. The works would also include preliminary site clearance (primarily any required vegetation removal) and grading works (including import of fill material required to provide the required Finished Ground Levels), site access works, site fencing, diversion of utilities and temporary diversions works to Bridleway-36. Irrespective of whether these works ultimately form part of an 'early works' strategy, the works have all been assessed as part of the EIA.

Construction Compounds

2.5.5 The **Works Plans Schedule 1: Authorised Project** of the **draft DCO [TR030008/APP/2.1]** includes three exclusively temporary components, which are spatially defined on the **Works Plans [TR030008/APP/4.2],** and comprise **Work No. 8** to **Work No. 10,** as detailed below. The approach described for each of the compounds below is indicative only.

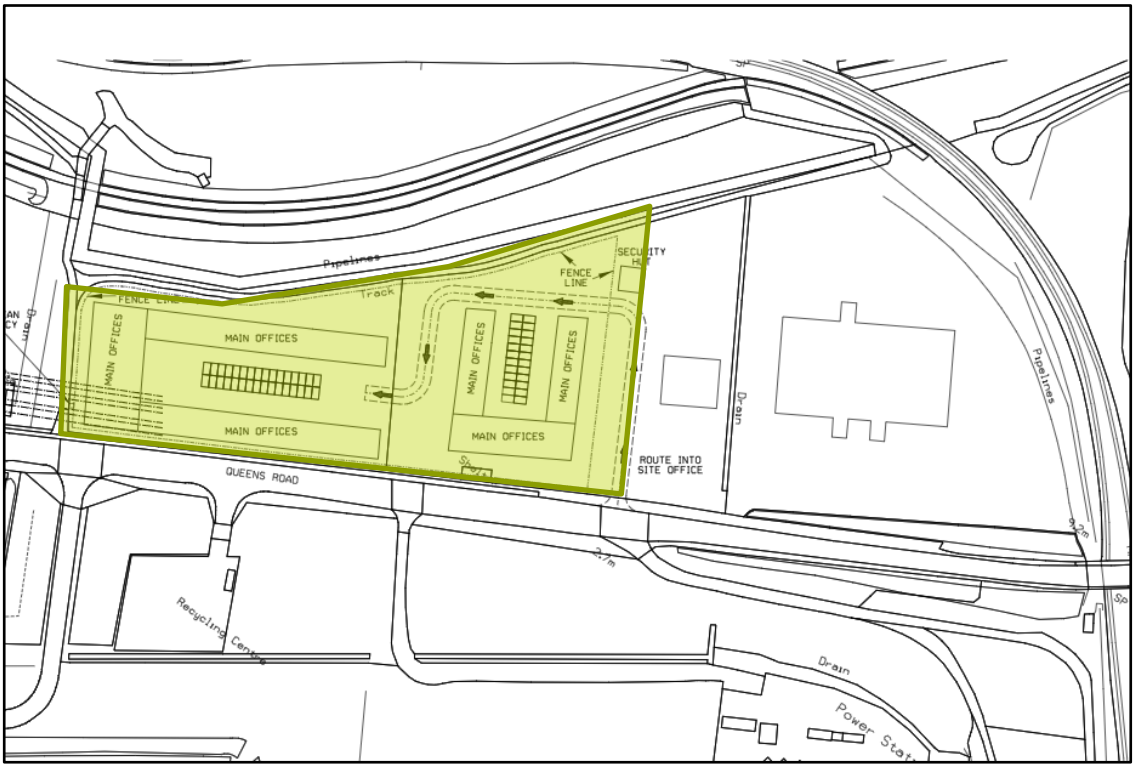
2.5.6 There would be two main temporary construction areas, one located off Queens Road (**Work No. 8**) and one off Laporte Road (**Work No. 9**), as well two additional temporary construction compounds, one located in the East Site (within the footprint of **Work No. 5**) and one in the West site (within the footprint of **Work No. 7**). It is envisaged that temporary welfare units would be required at localised work sites, but these would be self-contained and moved as required. These temporary construction areas are described in more detail below.

Queens Road Temporary Construction Area (Work No. 8)

2.5.7 The Temporary Construction Area which constitutes **Work No. 8** would involve the set up and use during **Phase 1** of a temporary site facilities area to accommodate temporary offices, welfare facilities, car parking, storage buildings and the formation of a temporary road access to Queens Road.

2.5.8 The location of the Temporary Construction Area is illustrated on **Figure 2.5 [TR030008/APP/6.3]** and an indicative arrangement is shown in **Plate 2-3**. Once **Phase 1** of construction is complete, the temporary construction area would be removed and reinstated to its current condition.

Plate 2-3: Indicative arrangement of Work No. 8



2.5.9 The Queens Road Temporary Construction Area (**Work No. 8**) would accommodate temporary offices, welfare facilities, car parking and storage buildings during the construction phase. The approximate area of the compound would be approximately 1.25ha. Access to the compound would require the formation of a temporary road access from Queens Road in addition to the existing road access.

2.5.10 The extent of the compound would be levelled and graded to allow hardstanding to be installed. As a minimum, the car park and all trafficable areas would have subbase in place. Concrete foundation pads would be cast for the office facilities which would be installed using a mobile crane. Cables for lighting of the compound will be installed. Fencing would be installed around the perimeter (either Heras or hoarding) and fenced pedestrian routes clearly marked, gated or fenced. Lighting would be required for security and safety. Local security detection equipment would be installed to prevent theft and damage.

2.5.11 A connection to the local power network will be made, however short-term use of silent generators may be required until such a connection is in place.

2.5.12 The compound's surface water and drainage approach would allow for a filter drain system to be installed to collect surface water run-off along the perimeter. The run-off would then be taken to an oil interceptor, silt buster or similar to treat run-off to an acceptable quality level. For foul drainage, it is anticipated that a septic tank or similar would be used and which would require regular emptying by a sewage tanker.

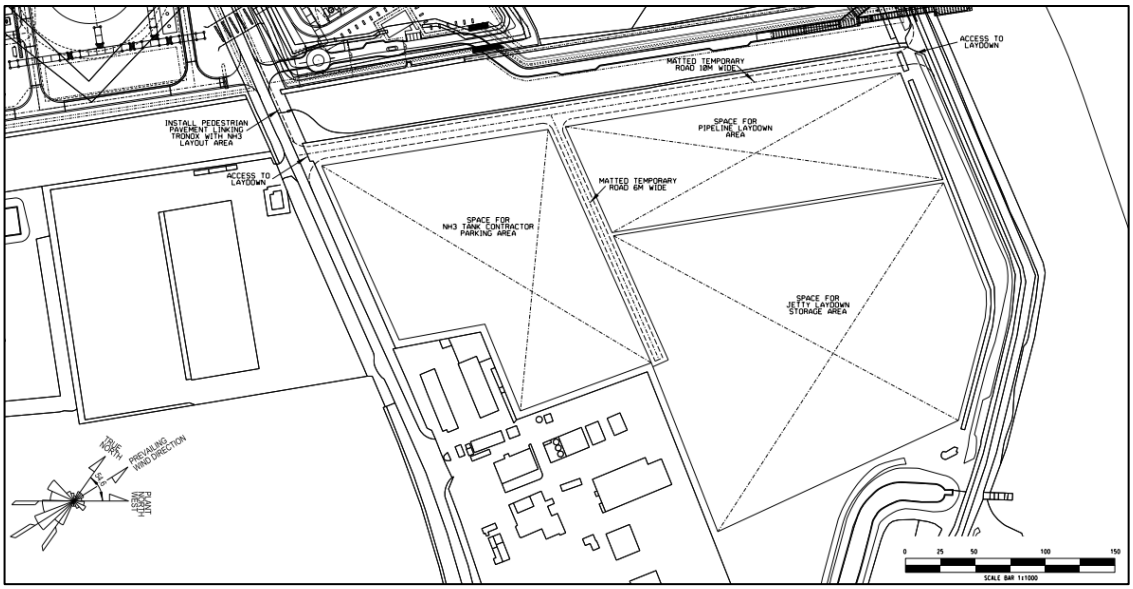
2.5.13 Once the compound is no longer required, the area would be returned to its original state, with the subbase and any concrete foundations being removed.

Laporte Road Temporary Construction Area (Work No. 9)

2.5.14 The Temporary Construction Area which constitutes **Work No. 9** involves the set up and use during **Phase 1** of a temporary laydown area for the storage of equipment and materials and the formation of a temporary road access to Laporte Road. The location of the Temporary Construction Area is illustrated on **Figure 2.5 [TR30008/APP/6.3]**. It is anticipated that **Work No. 9** would support both marine and terrestrial construction activities.

2.5.15 This construction area would be located in the large arable field to the east of the Long Strip woodland. This compound would be the main laydown area for the storage of materials and would accommodate storage containers for such purposes. The approximate area of the compound would be approximately 11.3ha, however the area anticipated to be initially required for access and laydown is expected to be approximately 4000m^2, with further sections of the field being required for laydown progressively to meet Project requirements. Access to the compound would require the formation of a temporary road access to Laporte Road. An Indicative arrangement of Work No. 9 is provided in **Plate 2-4** below. The layout would be adapted for any relevant flood risk constraints:

Plate 2-4: Indicative arrangement of Work No. 9



2.5.16 Access for deliveries and other construction plant would primarily be from the A1173 via Kings Road and Queens Road.

2.5.17 The land required for the compound would not require any foundation or excavation work, nor would any topsoil removal be undertaken. It is proposed that any area improvements would be minimal and would consist of only light grading and cover with breathable heavy duty ground mat protection to prevent any undue environmental impact. In the early stages of site establishment, Bridleway-36 would be diverted around the eastern side of the construction area to re-join the coastal path on the sea wall. A small temporary scaffold bridge may be required to support the bridleway diversion over the channel behind the sea wall.

2.5.18 Fencing would be installed around the perimeter (either Heras or hoarding) and fenced pedestrian routes clearly marked, gated or fenced. Lighting would be required for security and safety. Local security detection equipment would be installed to prevent theft and damage.

2.5.19 Once the construction compound is no longer required, which is currently assumed to be after the first phase of construction is completed, a duration of approximately 2.5 to 3 years, the area would be reinstated to its original state through lifting of the ground mat protection.

Temporary Removal of Kings Road Street Furniture and Overhead Cables (Work No. 10)

2.5.20 The Project is expected to use modularisation to reduce on-site works and maximise the works completed in specialised fabrication facilities off-site where practicable. This would require the delivery by sea to the Port of Immingham of large, prefabricated elements of operational plant and then the use of large HGVs to transport abnormal loads from the Port to the relevant parts of the Site. Modularisation and delivery by sea is specified in the **Outline CEMP [TR030008/APP/6.5]**.

2.5.21 In order to facilitate this, the works involve the temporary removal of street furniture and modification of overhead cables in four locations (as identified in **Figure 2.5** of the ES **[TR030008/APP/6.3]** to allow the passage of these loads along Kings Road to the Site. This would take place to allow up to 30 abnormal load movements over approximately a six-month period during Phase 1 of construction and a similar approach is likely to be required for subsequent phases, albeit with fewer movements.

2.5.22 The overhead lines would be either raised or lowered to allow passage of the abnormal loads and then reinstated. Street furniture would be taken down to accommodate the abnormal loads and reinstalled as soon as possible.

Other Works

2.5.23 In addition to the main temporary construction areas described above (8 & 9), parts of both the West Site (Work No 7) and eastern part of East Site (Work No. 5) would also be used as temporary construction areas during the construction of the works.

2.5.24 In addition to the localised street works described in Works No. 10, there will be a number of works in the highway within the Site Boundary to accommodate temporary and permanent access and utilities connections. These works are described more fully in Schedule 4 Streets subject to Street Works, Schedule 5 Alteration of Streets and Schedule 9 Access to Works of the **draft DCO [TR030008/APP/2.1]** and the **Utilities Statement [TR030008/APP/7.7]**.

2.5.25 In addition, Schedule 1: Authorised Project of the **draft DCO [TR030008/APP/2.1]** includes ‘Further associated development’ and ‘Ancillary Works’ which extend across the full extent of the Site. In summary, ‘further associated development’ enables the undertaking as required of works such as site clearance, creation of additional construction compounds, utility works, landscaping works and street works on a site wide basis. ‘Ancillary works’ constitute works that would not necessarily constitute development, such as vegetation removal, the installation of fencing and the demobilisation of construction works.

Plant and Equipment

2.5.26 Construction activities undertaken across the Project would involve the use of a range of plant, equipment and machinery depending on the location and nature of the works.

2.5.27 The final plant numbers and type would be determined by the construction methodology, although for the purpose of this assessment, reasonable worst-case estimates have been made of the types and numbers of plant and machinery and their locations likely to be used during the construction of the Project, for example in order to assess potential construction phase noise and vibration effects as presented in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**.

Construction Workforce

2.5.28 During construction, it is predicted that the workforce supporting the marine works would peak at approximately 220 personnel and the landside workforce would peak at 792. Both workforce peaks would be during Phase 1 of construction and for a 'realistic worst case assessment', it is assumed that the marine and landside terrestrial peaks would occur at the same time and during Year 2 of construction. A total construction workforce figure of 1012 workers has therefore been used to inform the assessments in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** and **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.

2.5.29 Further details are presented in the **Outline Construction Workers' Travel Plan** ("Outline CWTP") **[TR030008/APP/6.4]**, which accompanies the DCO Application and which is appended to the Outline Construction Traffic Management Plan ("CTMP") (approval of the final CTMP and compliance with it are secured through a Requirement in the **draft DCO [TR030008/APP/2.1])**. A proposed Requirement also requires a phasing plan to be submitted and approved before construction of the third hydrogen production unit or second hydrogen liquefier.

Street Works and Utilities

2.5.30 Construction of the Project would require the diversion, relocation or protection of a number of utility assets. It is likely that most of the required diversions would be undertaken as early works prior to the main phases of Project construction. The proposed diversion, relocation or protection of utility assets are set out in the **Utilities Statement [TR030008/APP/7.7].**

2.5.31 The area of the public highway and private roads which could be required for the placing and connecting of apparatus and associated works is outlined as follows on **Street Works and Accesses Plan [TR030008/APP/4.6]:**

a. Between the points marked B and C on sheet 4 for the unnamed access road north of Laporte Road.

b. Between points marked E on sheet 4 and the point marked D on sheets 4 and 5 for Laporte Road.

c. Between the point marked F on sheets 4 and 5 and the point marked G on sheet 4 for the private road to water treatment works south of Laporte Road.

d. Between the point marked C on sheets 4 and 5 and point marked I on sheets 5 and 6 for Queens Road.

e. Between the points marked V and W, the area between the points marked AI, AH and AJ, the area between the points marked AK and AL, the area between the points marked AM and AN and the area between the points marked AO, AP and AQ (in each case) on sheet 7 for Kings Road.

2.5.32 Temporary closure will be required for the construction of all of the temporary and permanent accesses required for the Project to construct the accesses, further details of the accesses are provided in **Paragraph 2.5.22** of this ES Chapter. Temporary closure and diversion of Public Rights of Way ("PRoWs") as well as temporary and permanent removal of informal access is required to facilitate the Project, further details relating to PRoWs are provided in **Paragraph 2.5.39** of this ES chapter.

2.5.33 As described under Work No. 10 above, temporary works are required to enable the passage of abnormal indivisible loads on Kings Road during the construction phase, this would involve the removal of signage and street furniture within the areas shaded red and marked respectively AD and AE on sheet 7 of **Street Works and Accesses Plan [TR030008/APP/4.6].** Temporary works are required to enable the temporary modification of existing overhead lines within the areas shaded purple and marked respectively AG and AF on sheet 7 of **Street Works and Accesses Plan [TR030008/APP/4.6].**

2.5.34 Construction works are required to provide an altered layout and revised signage and markings to enable the provision of the permanent speed limit of 30 miles per hour for an approximate distance of 660m along Laporte Road within the area shaded blue between the points marked D on sheets 4 and 5 and E on sheet 4 of **Street Works and Accesses Plan [TR030008/APP/4.6]** and **Traffic Regulation Measures Plan [TR030008/APP/4.8].**

2.5.35 Temporary overnight road closure including temporary parking restriction would be required on an occasional basis between the hours of 23:00 and 06:00 to all traffic on Laporte Road, Queens Road and Kings Road to allow large construction plant to access the Site. This would be required on approximately 30 occasions over a six month period during Phase 1. The temporary overnight closure will be of a length of approximately 2,890m and is shown as hatched dark blue and marked between point BC and BD on sheets 4, 5, 6, 7, and 8 on **Traffic Regulation Measures Plan [TR030008/APP/4.8].**

2.5.36 In addition to the temporary overnight closure described above, temporary road closure to all traffic of the area shaded green between the points marked S and T on Laporte Road on sheets 4 and 5 of the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7],** is also required to enable the construction of Work No. 4.

2.5.37 Temporary traffic lights would be required on Laporte Road at the direction of the undertaker at the location edged green between the points marked BE and BF on sheets 4 and 5 of **Traffic Regulation Measures Plan [TR030008/APP/4.8]** to allow large construction plant to cross Laporte Road at this location.

2.5.38 During construction, traffic management measures would be put in place to ensure that traffic flows on the road network are maintained, whilst allowing safe working at the interface between the existing road network and the Project.

2.5.39 Traffic management measures, in addition to those listed above, would include the following measures:

a. The use of signage and clear road marking systems.

b. Formation of safe access and egress points.

c. Communication of measures to stakeholders.

Public Rights of Way Works

2.5.40 Public Bridleway-36 crosses land within the Order Limits, between Laporte Road and the sea wall, along the eastern edge of the Long Strip woodland, whilst two other areas of informal access would be impacted by the Project. Details of how these interact with the Project can be seen on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**.

2.5.41 During the early works phase, the following measures would be implemented:

a. Diversion of Public Bridleway 36 onto a new temporary route – a temporary diversion route is proposed between the two points BB and BA shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**, with users being diverted around the eastern perimeter of the temporary construction area which would be established on the area defined for Work No. 9, to reconnect with the retained bridleway further to the east on the sea wall. Once the first phase of construction is completed, the bridleway would be re-instated on its current alignment and the temporary diversion would be closed.

b. Permanent removal of informal access between the APT Jetty and the point at which Public Bridleway 36 meets the sea wall – access would need to be removed permanently to enable construction and operation of the new Terminal and continued informal access west of the new jetty would be incompatible with this.

c. Temporary closure of informal access through the southern part of the Long Strip woodland, south of Laporte Road – access would need to be removed temporarily during the construction of the Project so limiting the number of walkers crossing Laporte Road in close proximity to the construction works in this area.

2.5.42 The impacts on PRoW are considered in **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.

Construction Materials

2.5.43 Estimates of the types and quantities of materials required to construct the Project, and those generated by construction, have been developed in order to inform the ES. The estimates are precautionary and allow the environmental assessments to consider a reasonable worst-case scenario.

2.5.44 Details of the main types and estimated quantities of construction materials required for the delivery of the Project are provided in **Chapter 20: Materials and Waste [TR030008/APP/6.2]**.

Construction Environmental Management Plan (CEMP) and Site Waste Management Plan ("SWMP")

2.5.45 An Outline CEMP **[TR030008/APP/6.5]** has been prepared and accompanies the DCO Application. This sets out the key measures to be employed during construction of the Project to control and minimise impacts on the environment. It describes how monitoring and auditing activities would be undertaken, in order to ensure that mitigation, management and monitoring measures during construction are carried out and are effective.

2.5.46 A Final CEMP would be prepared by the construction contractor in accordance with the Outline CEMP prior to the commencement of project construction, save for some enabling works. The Outline CEMP enables multiple Final CEMPs to be provided for example in relation to individual work numbers or for project phases to enable the efficient preparation and approval of relevant documents. A Requirement is included in Schedule 2 of the **Draft DCO [TR030008/APP/2.1]** which ensures that the contractor's Final CEMP(s) would be prepared in accordance with the principles set out in the Outline CEMP. The Final CEMP would include, as a minimum:

a. A code of construction practice specifying measures designed to minimise the impacts of the construction works.

b. A scheme for the control of any emissions to air.

c. A soil management plan.

d. A sediment control plan.

e. A scheme for environmental monitoring and reporting during the construction of the Project, including measures for undertaking any corrective actions.

f. A notification scheme for any significant construction impacts on local residents and for handling any complaints received from local residents relating to Project construction impacts.

2.5.47 In order to manage and monitor waste, including any spoil generated on-site, a Framework SWMP has been developed and is appended to the Outline CEMP with the DCO Application. This sets out how waste streams would need to be estimated and monitored and goals set with regards to the waste produced. The contractor's Final CEMP would be required to incorporate the principles of the Framework SWMP as appropriate.

2.5.48 The Applicant would require that the contractor segregates the waste streams on-site, prior to them being taken to a waste facility for recycling or disposal. All waste removal from the Site would be undertaken by licensed waste carriers and taken to licensed waste facilities.

2.5.49 An assessment of impacts in relation to construction and operational waste for the marine and landside infrastructure; and for waste generated during decommissioning of the landside infrastructure is presented in **Chapter 20: Materials and Waste [TR030008/APP/6.2]**.

Construction Traffic Management Plan (CTMP) and Construction Worker Travel Plan (CWTP)

2.5.50 An **Outline CTMP** [**TR030008/APP/6.7]** has been prepared and accompanies the DCO Application. This sets out the key measures to be employed during construction of the Project to manage construction traffic associated with the Project, such as vehicle routing and explain how monitoring and auditing activities would be undertaken, in order to ensure that the measures carried out are effective.

2.5.51 An **Outline CWTP [TR030008/APP/6.7]** has also been prepared and is appended to the Outline CTMP. This sets out the key measures to be employed during construction of the Project to minimise vehicle trips associated with construction workers and also how monitoring and auditing activities would be undertaken, in order to ensure that the measures carried out are effective.

Marine Construction Works

Overview of approach

2.5.52 Some marine construction works would likely be undertaken from the shoreside to form the jetty connection from the land to sea. The extent of work which would be conducted from the shore side would be determined by the proximity in which a jack-up barge can be brought alongside the existing seawall.

2.5.53 In the marine environment, the structures would rest upon an open piled network of steel tubular piles likely to be driven by vibro and percussive piling techniques. The deck for the approach trestle and jetty would be supported by either a pre-cast or in-situ concrete deck. A steel beam/truss structure with pre-cast concrete units may also be used. The topside pipework would be fabricated off-site in modules and moved into position. The high-level walkways between dolphins would be fabricated off-site and lifted into position. Overwater working would be strictly controlled in accordance with Port safety operations.

Capital Dredge (**Work No. 1** in part)

2.5.54 It has been determined that a capital dredge would be required for the berth. The maximum spatial extent of the dredge is estimated to be approximately 10,000m^2, dredged into existing bathymetry which varies across the area between 12.0m below Chart Datum (“CD”) to 14.5mCD. The berthing pocket with appropriate side slopes would be dredged to a maximum of 14.5m below CD, including an allowance for over dredge.

2.5.55 The majority of the berth pocket does not require any deepening as it is already below the required depth (i.e., 14.5m below CD). Furthermore, over most of the area that does not require dredging, only a relatively small amount of deepening is required. Therefore, in real terms the dredge represents a maximum deepening of 2.5m over a small area, with an extrapolated average lowering of 0.4m.

2.5.56 It is estimated that dredging of approximately 4,000m^3 of material would be required. This in situ volume is predominantly flat alluvial deposits such as unconsolidated material (silts, sands and gravel) of up to 3,900m^3, and consolidated material (e.g. glacial till with limited chalk inclusion) of up to 100m^3.

2.5.57 It is assumed that the dredged material would not be of a quality suitable for alternative use, such as for reclamation purposes, although this would be kept under review. A limited amount of chalk is anticipated in the dredge arisings, the chalk is expected to be weathered and fractured with no engineering properties to allow it to be reused on Site. The disposal of dredged material at sea would be fulfilled at licenced disposal sites within the estuary, at Holme Channel disposal site (HU056) to dispose of consolidated material, and Clay Huts disposal site (HU060) to dispose of unconsolidated material, subject to the dredge material being deemed suitable for disposal at sea by the Marine Management Organisation ("MMO").

2.5.58 A Waste Hierarchy Assessment ("WHA") which includes a more detailed consideration of the alternative options for the dredge material, is included as part of this ES (see **Appendix 2.A Waste Hierarchy Assessment [TR030008/APP/6.4]**).

2.5.59 The capital dredge methodology is anticipated to be backhoe dredge with split hopper barge. This would ensure that only one type of dredger would need to be mobilised. Dredge operations would be continuous and operate 24 hours a day and seven days a week.

2.5.60 The location of the proposed dredge and the dredge pockets are shown on **Figure 2.7 [TR030008/APP/6.3]**. The side pockets of the dredge pocket interface with the piles for the mooring dolphins, jetty head and the jetty itself. It would be favourable from a construction perspective to do the dredge after the piles have been installed. This may be possible for the jetty approach piles or mooring dolphin piles as the backhoe dredger could be situated perpendicular to the pile bents and trim around them as required. However, this may not be possible at the jetty head where piles are congested, and it would be difficult to dredge in and around them. Careful consideration would be given to the planning of the works to ensure that the dredging is executed at the correct time within the programme to mitigate the risk of further dredging being required prior to completion.

Works to the sea wall (**Work No. 1** in part)

2.5.61 The approach ramp which connects the landside to the jetty approach would bridge over the existing sea wall. The design would continue to allow pedestrian access for maintenance purposes only (no public access) and ensures a minimum clearance of 1.99m to the underside of the jetty (clearance may be increased during detailed design and in consultation with the Environment Agency). Once constructed, the design would continue to allow use of Public Bridleway 36 up to the sea wall but as noted earlier in this Chapter, the informal access which currently exists between the APT Jetty and the point at which Public Bridleway 36 meets the sea wall would be removed for operational reasons.

2.5.62 To futureproof the sea wall below the jetty, it would be extended up to a height of +7m Ordnance Datum prior to the jetty spans being installed. This would most likely be undertaken by tying into the existing wall using traditional formwork and in-situ concrete. As the existing sea wall will be retained, it is not anticipated that a secondary containment would be required.

Construction of the Jetty Access Ramp (**Work No. 1** in part)

2.5.63 A jetty access ramp would be constructed to accommodate the level change between the landside and the jetty structure. The jetty access ramp structure would most likely be constructed with driven steel piles and suspended concrete spans. The suspended concrete deck will rise to the jetty level in two areas prior to traversing over the existing sea wall.

2.5.64 The jetty access ramp would include a turnout ramp which would provide vehicle access to the northern side of the jetty; this is required for maintenance and emergency works. The construction of the turnout ramp would match that of the main ramp structure.

2.5.65 The suspended deck section could be driven steel tubular piles supporting primary pre-cast concrete, or steel deck beams, with an in situ concrete capping slab. This structural form would mirror the marine section of the jetty.

Construction of the Approach Jetty (**Work No. 1** in part)

2.5.66 It is currently estimated that the approach jetty to support the berth would be approximately 1.2km in length and would consist of a piled traverse rigid frames and concrete decks.

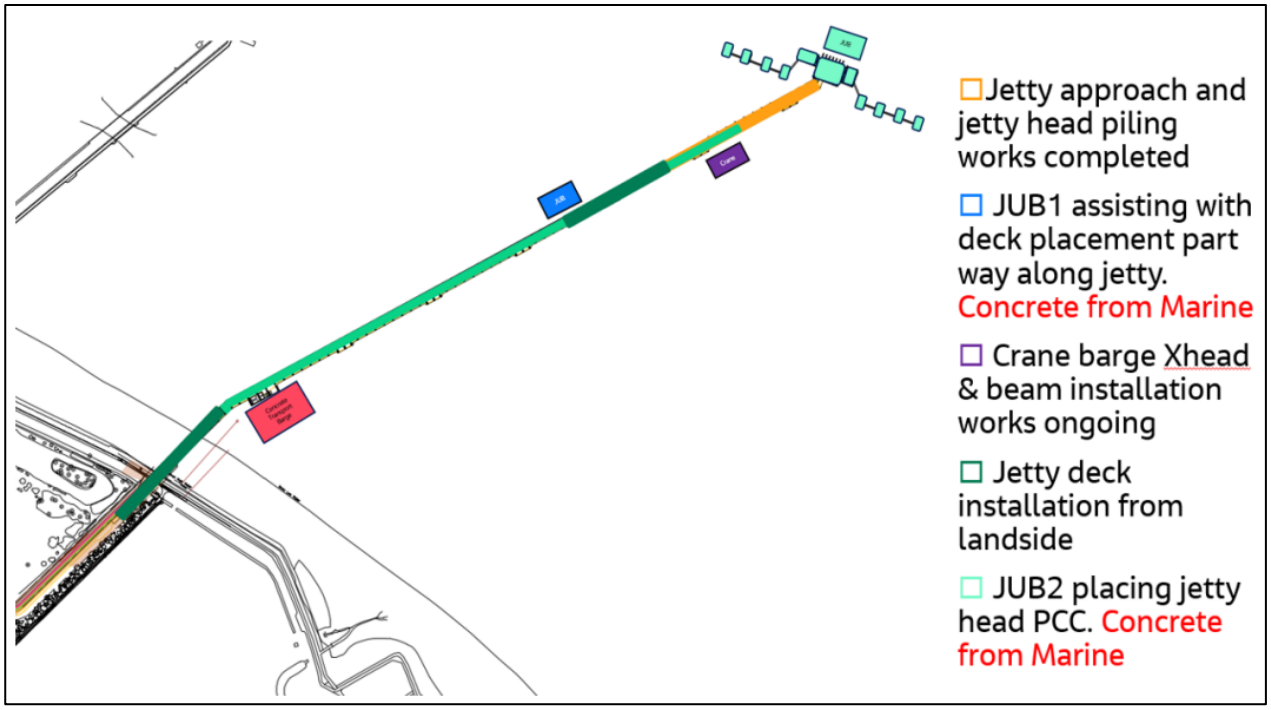
2.5.67 Temporary works using portal gates on jack-up barges would be set up for piling and then piles would be installed initially using vibro-piling to refusal. Percussive piling techniques may then be used to reach the final design level, although appropriate mitigation measures may need to be deployed.

2.5.68 Following the completion of piling, the piles would be cut to the required level prior to the pile-caps/crossheads being lifted into position. The pile-caps/crossheads may be made of steel or pre-cast concrete. Once the pile-caps/crossheads have been installed, steel or pre-cast concrete beams will be lifted onto the piles. An in-situ concrete decking will then be constructed on top of the placed beams. The lifting works would likely be undertaken by a crane barge which would follow behind the piling jack-up barge.

2.5.69 Service barges would be required to bring piles, pile-caps/crossheads, and decking from a marine load-out facility to the point of installation. It is anticipated that the marine load-out facility will be located within existing consented port areas.

2.5.70 The in-situ decking would be installed from landside at first, pumping the concrete from shore along the jetty. In-situ decking works would also be undertaken concurrently starting part way down the jetty (see **Plate 2-5**). This work would be serviced by the jack-up barge once it has completed the jetty piling activity. To supply ready-mix concrete to the jack-up barge, it would be necessary to see barges loaded from the onsite marine loadout facility (see **Plate 2-5**).

Plate 2-5: Example landside and marine construction sequence



Construction of the Jetty Head (**Work No. 1** in part)

2.5.71 It is proposed that a second jack-up barge is mobilised to install these piles concurrently with the jack-up barge installing the jetty approach piles. The piles would be installed using the same methods as the approach jetty using portal piling gates which are positioned on the side of the jack-up barge. The piles would be installed using a combination of vibro and impact pile driving.

2.5.72 Following completion of piling for the jetty head, pre-cast formwork would be installed between piles, reinforcing fixed and then the in situ concrete cast to form the deck. Fenders and bollards would then be installed.

2.5.73 The jetty head would likely incorporate a drainage system with interceptors/containment zones for spillages to protect the marine environment.

Installation of Breasting and Mooring Dolphins (**Work No. 1** in part)

2.5.74 The jetty head would be supplemented by two breasting dolphins and a further eight mooring dolphins. The length of some piles to support the breasting and mooring dolphins may require a lower section to be installed, an extension welded on in situ, before driving the piles to be finished level.

2.5.75 Following completion of the piling for each dolphin, the pre-cast formwork would be installed, reinforcing fixed and then the in-situ concrete would be cast. Bollards and fenders would be installed on the mooring face of the breasting dolphins. The mooring dolphins, breasting dolphins and jetty platform would include bollards.

Cathodic Protection (**Work No. 1** in part)

2.5.76 A cathodic protection would be required to protect the tubular steel jetty piles from corrosion. The system would either by an impressed current system comprising transformer units, cabling, anodes and monitoring equipment, or a galvanised anode system comprising aluminium-zinc anodes permanently attached to the jetty piles below low tide level.

Substructure Finishing works (**Work No. 1** in part)

2.5.77 Catwalks between the mooring dolphins, bollards, fenders, handrails, and mechanical and electrical services equipment would be installed following the above activities.

Topside Ammonia Delivery Systems (**Work No. 1** in part)

2.5.78 Following completion of the substructure the required ammonia delivery systems would be installed. This would consist of pre-assembled pipe racks, pipes, loading arms, and instrumentation and control systems. The marine loading arms and pre-assembled pipe racks would be lifted into position using a jack-up barge. Smaller items would be delivered by road transport and lifted using a mobile crane from the jetty top.

Construction Works in the Intertidal Zone

2.5.79 A section of the jetty approach structure would be constructed within the intertidal zone. The works in this zone would be undertaken by a jack-up barge which would be positioned during high tides, jacked up and prepared for work. The jack-up barge would then be able to proceed with the construction works at any state of the tide. Upon completion of piling in a particular location, the barge would await the next suitable tidal window to undertake the next move.

2.5.80 Some of the work in the intertidal zone may be conducted from the shoreside, due to insufficient water depths or barge access. These works would be undertaken within a temporary construction area situated behind the seawall.

Construction Vessels and Activity Information

2.5.81 During the construction of the jetty, there would be a requirement for multiple marine vessels. Piling operations would be undertaken from the jack-up barges; the number of barges used would be dependent upon the construction programme and work sequencing, however, it is envisaged that up to three barges would be used for the piling works. An example of a jack-up barge is shown in **Plate 2-6**.

2.5.82 Lifting in of oversized and heavy loads such as pre-cast bridge beams and headstocks could be undertaken by a crane barge.

Plate 2-6: Example Jack-Up Barge Undertaking Jetty Construction

2.5.83 The jack-up and crane barges would be supported by a fleet of support vessels which would include:

a. Tugs (likely three) used for repositioning the barge(s) into new pilling locations and for moving flat top supply barges from marine load-out to the work location.

b. Multi-cats (likely two) used to resupply the barge(s) with piles, plant, consumables and associated jetty fabrications.

c. Flat top barges (likely four) used to transport equipment to the work area, house plant etc.

d. Safety boat (likely one) used to support operations and assist with crew transfers.

e. Dredging vessels formed of backhoe dredger and split hopper barges.

2.5.84 During the jetty construction, it is anticipated that the tug, multi-cat vessels and a safety boat would be operating in the construction area daily. It is anticipated that multiple barge moves would be undertaken each week.

Sources of Noise and Vibration during Marine-Side Works

2.5.85 Some noise and vibration can be expected during the construction of the approach jetty, jetty head, breasting and mooring dolphins. Depending on the piling technique used, it is anticipated that some isolated, short-duration noise and vibration would be generated particularly during percussive piling. It is not proposed to use pre-cast driven piles. Further details as relevant are included in **Chapter 7: Noise and Vibration [TR030008/APP/6.2].** Noise trigger levels are

be defined in the **Outline CEMP [TR030008/APP/6.5]**. Marine working hours including the approach to marine piling are covered in **Paragraph 2.5.119**.

2.5.86 In order to reduce the level of potential impact associated with noise (underwater and airborne) and vibration during marine construction works, several mitigation measures would be implemented. This includes, but is not limited to, the use of soft start procedures, vibro-piling where possible and seasonal working restrictions. An acoustic barrier/ visual screen would also be installed on the approach jetty for a period of time, and only on those sections of the approach jetty within 200 m of exposed intertidal foreshore, to screen the construction of the topside infrastructure. These measures are detailed further **in Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and **Chapter 10: Ornithology [TR030008/APP/6.2].**

Marine Construction Lighting

2.5.87 During marine construction works, various forms of lighting would be required to safely undertake the works. All support vessels and barges would use any navigational lighting which is required to comply with the procedures of the Port of Immingham and to ensure they can be seen by other vessels. This lighting would be required at all times. Additionally, the support vessels and barges would require general lighting during operational hours.

2.5.88 Task lighting would be used by the vessels and barges during operational hours to suitably illuminate the working area(s), for example, the pile gates during piling works and areas of the piles where lifting operations are being conducted.

2.5.89 Lighting would also be required on the shoreside, within the temporary construction area. The temporary storage area and the access road leading to the jetty embankment would require general lighting. Task lighting would be required at the flood defence wall where the bank seat construction would be undertaken. The task and general lighting would only be required during operational hours. Jetty Access Road (Work No. 2 in part)

2.5.90 Although part of the landside infrastructure, the construction of the jetty access road from the East Site to the jetty landfall would need to be sequenced with the construction of the Terminal (described under Work No 1. above). The Jetty Access road, from the East Site to the jetty landfall, would be constructed using heavy construction plant and would commence as early as possible in the construction schedule to ensure that there is land-based access to the jetty alignment to facilitate the construction of Work No. 1.

2.5.91 The works to construct the jetty access road would involve vegetation and topsoil strip as detailed in **Section 2.4**, followed by excavation down to formation. Drainage and utilities trenches would be installed prior to building up the road levels using suitable fill material. The road surface is likely to be asphalt, and the required road build-up would be installed by a specialist contractor.

Culverts (Work No. 1 and No. 2 in part)

2.5.92 There are three Ordinary Watercourses in the development site which will be impacted by the construction of the jetty access ramp Work No. 1 and associated jetty access road Work No. 2. The access road and associated jetty access ramp will need to pass over, or be constructed adjacent, to these watercourses.

2.5.93 Two culverts are likely to be required landside in Work No. 1, one where the new APT emergency egress footway crosses an existing field ditch which runs behind (i.e. landward of) the flood defence wall; the conveyance within the ditch will be maintained through the provision of a precast concrete pipe and the second where the new jetty access ramp and Environment Agency access ramp will be constructed over an existing field ditch which runs behind (i.e. landward of) the flood defence wall; the conveyance within the ditch will be maintained through the provision of a concrete lined channel.

2.5.94 Three culverts are likely to be required landside in Work No. 2 one where the new jetty access road crosses an existing roadside ditch near the landside access road junction with Laporte Road; the conveyance within the ditch will be maintained through the provision of a precast concrete piped culvert. The second where the new jetty access road crosses an existing field ditch mid-way along its length; the conveyance within the ditch will be maintained through the provision of a precast concrete piped culvert, and the third where the new jetty access road runs parallel with the existing field ditch; the section of ditch to the south of the access road crossing will be retained as a natural channel; however, it's profile will be modified to improve its hydraulic characteristics. The section of ditch to the north of the access road crossing will be hydraulically enhanced through the provision of a concrete lined channel due to its close proximity to the proposed infrastructure.

2.5.95 Construction of the culverts and lined channels would require the watercourses to be temporarily blocked and a pumping system installed to 'over pump' the flows downstream of the construction area. The section of the lined channel in the Long Strip would have a grated cover to facilitate pipe rack maintenance.

Overall approach to Construction of the Hydrogen Production Facility

2.5.96 During the detailed design stage, the approach to construction would be defined. For the purposes of this ES, it is assumed that certain equipment would be modularised and pre-fabricated/assembled. Modularised units, along with large specialist equipment are likely to require special transport considerations as explained below. Off-site pre-fabrication would be supplemented by on-site construction of certain larger components which due to their size or weight, may involve fabrication and erection on-site.

2.5.97 Small components and modules would be transported using the existing road network with more significant modules being transported by ship along the Humber Estuary to the Port of Immingham where they would be offloaded onto suitable haulage vehicles and transported into the Site using Kings Road with some temporary local raising/lowering of overhead lines and removal of street furniture required (**Work No. 10**).

2.5.98 Construction traffic and road haulage would be achieved along designated routes as outlined within the **Outline CTMP [TR030008/APP/6.4]**. The Final CTMP would be prepared by the construction contractor in accordance with the Outline CTMP and is secured through a Requirement of the **draft DCO [TR030008/APP/2.1]**.

Pipeline construction (Work No. 4 and Work No. 6)

2.5.99 The pipelines would be installed as a combination of above ground sections and below ground sections. Installation below ground would be used for the pipeline corridor (Work No. 6) linking the East and West Sites other than where these pipelines would be within the sites themselves and connect into other above ground structures).

2.5.100 The pipeline installation would involve clearing of areas, preparation for pipeline installation and either Horizontal Directional Drilling ("HDD") or micro tunnelling techniques.

2.5.101 Pipeline crossing of Queens Road and the railway line would be required. It is envisaged that HDD would be used for these pipeline crossings. Pipe crossing of Laporte Road would also be required and it is envisaged that a culvert would be constructed in this location (Work No. 4).

2.5.102 The pipeline route would be marked with marker posts which would be set to ensure visibility.

East and West Site (Work No 3, No. 5 and No. 7.) construction works

2.5.103 The East and West Sites would require civil, mechanical and piping ("M&P"), and electrical and control ("E&C") construction works.

2.5.104 Civil works would include the use of piled foundations in those areas where the ground is unsuitable for supporting shallow foundations. This is expected to include the West Site, the East Site and the pipe-rack that runs from the jetty landfall to the East Site. Pile design is not yet complete, but at this stage it is anticipated that bored cast in-situ piles are likely to be adopted to minimise noise and vibration during piling activities. The exact piling technique to be employed would be finalised during detailed design. There is also a possibility that ground improvement works may be carried out in the East Site or West Site, such as installation of vibro-concrete columns or controlled modulus columns. The need for such works, and the precise techniques to be adopted, would be defined during detailed design. Some land-raising is expected to be required on these sites to bring the FGL up to a maximum of 2.5-3.8m AOD, where required. The HGV numbers associated with the importation of the required material are included within the HGV numbers for Phase 1 of the project covered in **Paragraph 2.5.121** onwards below.

2.5.105 Where practicable, the Project would use modularisation to reduce the on-site works and maximise the works completed in specialised off site fabrication facilities, to improve the safety and efficiency of the work. Sections of the plant delivered in modules will include pre-assembled pipe-racks, fired heater sections, flue stacks, compressors and pumps. M&P works would involve installation of large equipment and modules and would require heavy equipment such as cranes and transport vehicles. Coatings would be applied off-site with only coating touch up applied at the Site. An on-site fabrication facility would support the erection of steel and piping systems.

2.5.106 The E&C works would include the installation of modular electrical and control buildings which would be constructed off-site and assembled on site. The Project would be connected to the electricity transmission network via overhead or underground electricity transmission cables. Power distribution to the power distribution centres ("PDC") across the facility and onwards to the power users would be via cables installed in tray on pipe-racks or via underground ducts. Control system cabling will be installed to connect local instrumentation to the control room via the various process instrumentation buildings ("PIB") across the facility. Cabling within modules will be pre-installed during offsite fabrication.

2.5.107 The various buildings across all sites will be either pre-fabricated and transported to site, constructed using steel frame and steel cladding or brick built. The methodology for each building will be confirmed during detailed design phase.

Ammonia Storage Tank (**Work No. 3A**)

2.5.108 The ammonia storage tank (**Work No. 3A**) would be situated on the East Site – Storage Area (**Work No. 3**) and would be constructed by a specialist tank contractor. The tank will have an inner and outer wall to provide dual containment. The tank would be constructed from large sections brought to Site via the Port which are lifted into position and welded. If the tank outer wall is constructed from concrete, this would be done using a slipform technique.

Construction Lighting

2.5.109 Construction lighting would be required in areas where natural lighting is unable to reach (sheltered/confined areas) and prior to permanent lighting being installed. Lighting may also be required around the landside areas of the Site for night-time construction and during core working hours within winter months.

2.5.110 Artificial lighting would be provided to maintain sufficient security and health and safety for the Site during construction. The **Outline CEMP [TR030008/APP/6.5]** outlines measures during construction to avoid excessive glare and minimise spill of light to nearby receptors (including local residents and some ecological receptors) outside of the Site as far as reasonably practicable.

Hazard Prevention

2.5.111 The potential risk events during Project construction have been identified and assessed in **Tables 22.4** and **22.5** of **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**. Where risks cannot be eliminated, they would be reduced to as low as reasonably practicable ("ALARP") via controls and mitigation that primarily involve compliance with Construction Design and Management ("CDM") Regulations and compliance with the measures set out in the Final CEMP(s) (see **Paragraphs 2.5.45** - **2.5.49**).

2.5.112 A COMAH Safety Report would be submitted for review by the competent authority prior to Project construction under the COMAH Regulations 2015. The purpose of this report is to demonstrate to the competent authority that all measures necessary to reduce risk have been taken.

2.5.113 For design and construction, a competent and adequately resources CDM Coordinator and contractor would be appointed. The Applicant would ensure that its own staff, its designers and contractors follow the Approved Code of Practice ("ACoP") laid down by the CDM Regulations 2015.

Commissioning

2.5.114 Commissioning of the hydrogen production facility would include testing and commissioning of the process equipment in order to ensure that all systems and components installed are in accordance with the requirements of Air Products and meet the requirements of the Environmental Permit. Commissioning of the process equipment on the jetty topside would be handled in a similar way.

Site Access

2.5.115 There are eight proposed temporary means of access to facilitate the construction of the Project and eight permanent means of access to facilitate the operation of the Project. In some instances, the temporary accesses will become permanent following completion of the construction phase as the access would be required for both the construction and operation of the Project. This is clarified below where applicable.

2.5.116 The locations of the temporary means of access are shown as areas shaded orange and the permanent means of access shown as areas edged purple on **Street Works and Accesses Plan [TR030008/APP/4.6]**. Illustrative designs of each access are available within **Figure 4.3: Illustrative Layouts [TR030008/APP/4.3].**

2.5.117 The temporary means of access are defined below:

a. Temporary access AA (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the West Site, specifically to Work No. 7 from Kings Road. This access will be required for the construction phase and will then remain in use during the operation of the Project.

b. Temporary Access AB (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the West Site, specifically to Works No. 7 from the A1173. This access will be required for the construction phase and will then remain in use during the operation of the Project.

c. Temporary Access AC (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the West Site, specifically to Works No. 7 from the A1173.

d. Temporary Access M (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the east site, specifically to Work No. 3 from the unnamed private road to water treatment works, this road then connects to Queens Road. This access will be required for the construction phase and will then remain in use during the operation of the Project.

e. Temporary Access O (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 3 from Laporte Road.

f. Temporary Access N (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 5 from Laporte Road.

g. Temporary Access P (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 9 from Laporte Road.

h. Temporary Access U (as labelled on **Street Works and Accesses plan [TR030008/APP/4.6])** provides access to Work No. 8 from Queens Road.

2.5.118 The permanent means of access are defined below:

a. Permanent access AA (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6**]) provides access to the West Site, specifically to Work No. 7 from Kings Road. This access is required for the construction phase and will then remain in use during the operation of the Project.

b. Permanent Access Z (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the West Site, specifically to Work No. 7 from Kings Road.

c. Permanent Access AB (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6**]) provides access to the West Site, specifically to Work No. 7 from the A1173. This access will be required for the construction phase and will then remain in use during the operation of the Project.

d. Permanent Access M (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6]**) provides access to the east site, specifically to Work No 3 from the unnamed private road to water treatment works, this road then connects to Queens Road. This access will be required for the construction phase and will then remain in use during the operation of the Project.

e. Permanent Access K (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 2 from Laporte Road.

f. Permanent Access J (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 5 from Laporte Road.

g. Permanent Access L (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 3 from Laporte Road.

h. Permanent Access A (as labelled on **Figure 4.6: Street Works and Accesses plan [TR030008/APP/4.6])** provides access to the East Site, specifically to Work No. 5 from unnamed private access road.

Construction Working Hours

Marine Construction Working Hours

2.5.119 In months where percussive piling is permitted within the water body, spatial, diurnal and duration restrictions apply for certain periods as set out in the Deemed Marine Licence which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]**. For example, it is anticipated that night time restrictions will apply to percussive piling works within the water body for Work No. 1, seaward of the mean highwater mark, outside the hours of sunrise and sunset in certain summer months (June and August) and between 19:00 and 07:00 in certain winter months (March, September and October), seven days a week. Other marine construction activities for Work No. 1 including dredging, are assumed to be undertaken on a 24-hour basis and continue until completion for safety or quality reasons. The marine construction working hours would be secured through the Deemed Marine Licence.

2.5.120 Some landside construction activities to support marine working may be required during the marine construction working hours. This landside working would be restricted to the work areas defined for Work No 1, 2 and 9. The landside activities are expected to include material supply, plant maintenance and vehicle movements to support the construction of Work No. 1.

Landside Construction Working Hours

2.5.121 Core construction working hours for the landside works is between 07:00 and 19:00 Monday to Saturday. A Requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1]** secure the landside construction working hours and the approach to exceptions to the core working hours. Exceptions may be required because certain construction activities cannot be stopped, such as concrete pouring or tank welding, to support the marine works (and also to manage the construction programme). Where on-site works are to be conducted outside these core hours, they would comply with any restrictions secured in the Requirements or would be agreed with the local planning authority. The need for any such works would be minimised where possible and would be carefully managed to reduce effects on local people.

Construction Traffic

2.5.122 The largest daily development traffic trips (workforce and HGVs) are predicted to be generated in the first phase of construction (Year 2) and have been calculated to total approximately 1,717 two-way trips, with the majority of trips associated with workers commuting to and from the Site.

2.5.123 The construction workforce is anticipated to travel to the Site via the existing trunk road and local road networks. Construction staff arriving by car would use on-site parking, primarily within the Temporary Construction Areas [Works No. 8 and No. 9 through use of Work Nos. 5A and 7 during the early phases of construction].

2.5.124 HGVs delivering construction materials would also access the Site from the A180 and A1173. The volume of HGVs associated with construction of the Project on the network is predicted to be at its maximum of 199 daily two-way vehicle movements (99.5 in and 99.5 out) during Year 2 of construction. The other 6 phases of the construction period, would generate at least 50% less traffic than the peak as described above and as assessed in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.

2.5.125 Combining construction workforce vehicle movements with construction HGV movements over the entire construction programme shows the overall peak in vehicle movements which would occur would be 1,717 movements in total (1,518 two-way car/van movements and 199 two-way HGV movements per day). Further information on traffic volumes and routing is provided in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.

2.5.126 It is anticipated that, prior to the start of each construction phase, the contractor would prepare a Final Construction Traffic Management Plan to manage HGV movements, as well as a Final CWTP (to be appended to the CTMP) to manage the trips made by the construction workers (including encouraging car sharing) and thus reduce the impact of the workforce upon the highway network. The Final CTMP(s) and CWTP(s) would be based on the measures set out in the **Outline CTMP [TR030008/APP/6.4]** and **Outline CWTP [TR030008/APP/6.4]** which are submitted with the DCO Application. The production of the final (or phased) CTMP(s) (and associated CWTP(s)) is secured through a Requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1]**.

2.5.127 These plans would set out measures and controls to limit the number of trips on the local road network in the peak hours, and as such aim to limit the traffic impact of the construction phase as far as possible. Such plans would be implemented for the duration of the Project construction phase.

2.5.128 It is proposed that the largest abnormal loads would be received at the Port where they would be offloaded onto suitable haulage vehicles and transported into the Site using the A1173, Kings Road. In order to facilitate this, the temporary removal of some specific items of street furniture and overhead cables in four locations (as identified in the **Works Plans [TR030008/APP/4.2]** would be required to allow the passage of these loads along Kings Road to the Site. This would take place up to 30 times over a six month period during Phase 1. Similar movements are also likely to be required in Phases 2-6 to support the build out of the remaining phases of the hydrogen production facility but the frequency of movements is expected to be lower. The overhead lines would be modified overnight to accommodate the abnormal loads and would be reinstated after the transport. The street furniture would be taken down and reinstated as soon as practicable.

2.6 Operational Phase

2.6.1 The **draft DCO [TR030008/APP/2.1]** permits the operation, use and maintenance of the Project. The definition of “maintain” in the **draft DCO [TR030008/APP/2.1]** is stated to include “inspect, repair, adjust, alter, remove or reconstruct” and those activities have been taken into account in the assessment contained in this Environmental Statement.

Terminal Operation

2.6.2 The Terminal would operate 24 hours a day, seven days a week and 365 days a year. The Terminal would have capacity of approximately 11 million tonnes per annum and so be able to accommodate up to 292 vessel calls per year and it is anticipated that up to 12 of these calls would be associated with the hydrogen production facility. The vessels which make up the remaining 280 calls to the Terminal are expected to serve the future carbon capture and storage market and other liquid bulk energy product markets.

2.6.3 The total vessel numbers have been assessed as the worst-case scenario in terms of potential environmental effects in the relevant topic chapters of this ES. A series of assumptions for shipping sizes, imported material and origin have been made as follows:

a. 660,000 tonnes of Terminal capacity would be used for the import of green ammonia for the hydrogen production facility (comprising 12 ships each transporting 55,000 tonnes) from the Middle East and Netherlands.

b. For the carbon capture market, it is assumed that there would also be approximately 9,800,000 tonnes of CO2 which are imported from a maximum distance of 500 nautical miles.

c. It is also assumed that domestic (UK) re-export of liquid bulk products is likely to occur to three port destinations (Teesport, Port Talbot, Cardiff) with an assumed 5,000,000 tonnes re-exported to the furthest distance port (Port Talbot). Of this only 100,000 tonnes of the domestic exports are expected to relate to Air Products shipping of ammonia.

d. The future origins and destinations are however likely to vary substantially based on individual future jetty users and their patterns of operation. The current shipping assumptions are considered to be a realistic worst case, based on current knowledge available.

2.6.4 Operational staff numbers for the Terminal are likely to be up to 14 with at least some staff working to shift systems.

Operation of the Hydrogen Production Facility

2.6.5 The hydrogen production facility is intended to be a continuous operation, although this would be dependent upon shipping frequency. The intention is therefore that the facility will operate 24 hours a day, seven days a week and 365 day a year.

2.6.6 Operational staff numbers and shift patterns would vary across the facility depending upon the duties being undertaken as illustrated in **Table 2-12.**

Table 2-12: Indicative Operational Staff Numbers and Shift Patterns

Role	Staff Numbers	Days	Base Location
Facility Manager	1	Mon – Fri	Site
Production Manager	1	Mon – Fri	Site
Integration Manager	1	Mon – Fri	Site
Environment, Health & Safety Coordinator	1	Mon – Fri	AP Central Offices
Production Superintendent	1	Mon – Fri	Site
Shift Supervisors	4	7 days a week	Site (shift rotation)
Plant Operators	16	7 days a week	Site (shift rotation)
Jetty Operators (Topside infrastructure)	8	7 days a week	Site (shift rotation)
Clerks	1	Mon – Fri	Site
Plant Maintenance	4	7 days a week	Site
Drivers	50	7 days a week	Transient Work Force
Contractor	8	7 days a week	3rd party contractor

Role	Staff Numbers	Days	Base Location
Janitor	2	Mon – Fri	3rd party contractor
Security	9	7 days a week	3rd party contractor
Other workers	14	5 days a week-	AP- Transient Work Force Based at the site but will travel outside the site
Total	120		

2.6.7 It is anticipated that once fully operational, a fleet of up to 50 tanker trailers and tractor units would operate in distributing the green hydrogen throughout the UK. This fleet is predicted to generate an average of around 96 daily movements (48 inbound, 48 outbound) and these movements would take place across the full day (24 hours).

Hazard Prevention

2.6.8 The Applicant aims to protect human health by safely and responsibly managing activities on Site. Based on the volumes of hazardous materials to be stored on the Site, a Hazardous Substance Consent will be required and an application was duly submitted to NELC in March 2023 (application reference number DM/0077/23/HS). The hydrogen production facility would also be regulated in accordance with the HSE's requirements through the COMAH Regulations 2015 and other applicable legislation, industry standards and best practice for the design of process equipment identified in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

2.6.9 Continuous monitoring would observe operational conditions such as temperature and pressure, with routine inspection and planned preventative maintenance carried out on all assets to ensure the plant operates safely and efficiently.

2.6.10 All personnel associated with the operation of the Project facilities would be subject to the highest standards of training and competency assurance, including process operators, vessel and jetty personnel and road tanker drivers.

2.6.11 The proposed operation of the Site and the on and off-site emergency plans would be subject to rigorous appraisal by the COMAH competent authority and other stakeholders. As the operator of the facility, Air Products notified the HSE in April 2023 and will submit two COMAH Safety Reports for review (one submitted prior to construction and a second prior to operation), as required by Regulation 7 of the COMAH Regulations to demonstrate that taken all measures necessary to prevent major accidents and to limit the consequences to people and the environment of any that do occur have been taken. The competent authority would authorise Site operations through review / assessment of the COMAH Safety Report.

2.6.12 When operational, the Site would form part of the existing Humberside COMAH cluster. The purpose of these groups is to share information and provide a cooperative, collaborative forum for operators of COMAH sites. The information shared includes the hazards which are present on each site and emergency response plans. Humberside is one of the main clusters in the UK, with sites working together to share information with local residents and people working near the sites as well as with the competent authority and local authorities.

2.6.13 The implications for land uses around the hydrogen production facility have been carefully considered (see **Table 22.2 Relevant Legislation, Policy and Best Practice Regarding MA&D**). As mentioned in **Section 2.3**, the residential use of certain properties on the west side of Queens Road would need to cease as residential use is not considered to be compatible with the operation of the hydrogen production facility on the West Site (based on an assessment undertaken on behalf of Air Products) such that the continued residential uses would be an impediment to the grant of Hazardous Substances Consent. Discussions are ongoing with the owners and occupiers and, where it is not possible to acquire those properties through negotiation, acquisition powers for these properties are sought through the DCO.

2.6.14 Further, as mentioned in **Section 2.3**, a number of businesses and commercial properties are also present in the same area on the west side of Queens Road. It is not expected that the operation of the hydrogen production facility will have any materially adverse impacts on the continued operations of other business in the area based on assessments undertaken.

2.6.15 It is the strong preference of both ABP and Air Products to acquire all necessary interests in land for the construction and operation of the Project through negotiation. Both parties aim to continue discussions with all affected parties through the development of the Project. See the **Statement of Reasons [TR030008/APP/3.2]** for further details.

Environmental Management

2.6.16 The hydrogen production facility would comply with the Environmental Permitting (England and Wales) Regulations 2016 (Ref 2-4) (“EPR”) by obtaining an Environmental Permit from the Environment Agency as detailed in **Chapter 4: Legislative and Consenting Framework [TR030008/AP/6.2]**.

2.6.17 The Site would operate in line with appropriate standards and the operator would implement and maintain an EMS which would be certified to International Standards Organisation (“ISO”) 14001. The EMS would outline the procedures required to ensure that the Site operates to an appropriate standard.

2.6.18 Sampling and analysis of pollutants would be carried out where required, including monitoring of exhaust emissions levels using continuous emissions monitoring systems (“CEMS”) prior to discharge from the stacks, in accordance with the Environmental Permit.

Operational Heavy Goods Vehicle Movements

2.6.19 HGVs would use the A1173 to access the Site. Operational traffic movements are detailed in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**. In summary, it is anticipated that during the operational phase of the Project, total HGV movements at the Site would be approximately 96 movements (48 in and 48 out) per day. These figures include movements associated with the delivery of consumables and removal of waste products.

2.6.20 The air quality, noise and transport assessments (**Chapters 6: Air Quality; 7: Noise and Vibration** and **11: Traffic and Transport [TR030008/APP/6.2]**) consider the worst case traffic profile associated with that topic, which are associated with construction – a detailed assessment of the operational phase of the Project is not considered necessary as the vehicle numbers generated would be considerably lower that the screening threshold for a more detailed assessment (e.g. >200 vehicles per day).

Maintenance Dredging and Disposal

2.6.21 During operation of the Project, maintenance dredging will potentially be required in the same way as currently occurs at the Port. The modelling of the scheme (as reported in **Chapter 16: Physical Processes [TR/030008/APP/6.2])** indicates that the berth pocket, once dredged, will remain swept clear of deposited material by the flood and ebb tidal flows (in much the same way the existing Immingham Oil Terminal berths are). Consequently, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).

2.6.22 Should maintenance dredging be required, it is proposed to be incorporated within the maintenance dredge licence for Immingham (L/2014/00429/1) as part of the renewal of the licence at the end of 2025.

Hydrogen Production Facility Maintenance

2.6.23 The hydrogen production facility would be designed and operated as a continuous operation high reliability plant being on stream over 95% of the time. The facility would have a planned preventive maintenance programme. This would include each Hydrogen Production Unit being shut down for several weeks every two years for catalyst change, whilst other equipment would be taken offline for maintenance regularly without impacting operation of the facility. In order to achieve such a high level of continued operation, certain equipment and controls would be duplicated to allow operations to continue whilst maintenance is underway.

2.7 Decommissioning

2.7.1 The main elements of the Terminal would not be decommissioned. The jetty, jetty head, loading platforms, access ramps and the jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that they could be used for port-related activities to meet a long-term need.

2.7.2 The hydrogen production facility would have a design life of up to approximately 25 years, although the operational life could be longer, depending on its integrity and market conditions at that time. When appropriate, this infrastructure would be decommissioned. It is anticipated that plant and equipment on the jetty topside associated with hydrogen production would be decommissioned in parallel with the decommissioning of the related landside elements.

2.7.3 Decommissioning would be undertaken safely, in line with specific procedures and subject to risk assessment and permit to work schemes, and with regard to the environmental legislation at the time of decommissioning. The required licences and permits would also be acquired.

2.7.4 Decommissioning of the hydrogen production facility would likely involve leaving underground infrastructure such as pipelines, piles, foundations, culverts and drainage in situ and making them safe. All above ground infrastructure associated with the Project would likely be dismantled and all materials removed would be reused or recycled where possible or disposed of in accordance with relevant waste disposal regulations at the time of decommissioning. Land would be restored to a satisfactory state.

2.7.5 An Outline Decommissioning Environmental Management Plan ("DEMP") is submitted as part of the application for development consent. A Final DEMP would be produced prior to decommissioning or demolition works being undertaken, which would detail measures to be implemented to avoid or reduce environmental impacts during the decommissioning of the hydrogen production facility and the related infrastructure on the topside of the jetty. The provision of a DEMP is secured by Requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1]**.

2.8 References

Ref 2-1 Groundsure. (2022).Enviro+Geo Insight Report (GS-9009838).

Ref 2-2 North East Lincolnshire Council (February 2010). Landscape Character Assessment.

Ref 2-3 Defra. (2022). MAGIC Maps. Available at: https://magic.defra.gov.uk/MagicMap.aspx (Accessed: August 2022).

Ref 2-4 UK Statutory Instruments. (2016). No. 1154. The Environmental Permitting (England and Wales) Regulations.

Ref 2-5 Environment Agency (2023) Get flood risk information for planning in England

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 3: Need and Alternatives

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 3: Need and Alternatives

Regulation Reference	APFP Regulation 5(2)(a)
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Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

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3 Need and Alternatives

3.1 Introduction

3.1.1 This Chapter of the Environmental Statement ("ES") explains the need for the Project, which is established by the National Policy Statement for Ports ("NPSfP") (Ref 3-1) and further reinforced by other relevant national and local policy. A detailed explanation of need is set out in Chapter 5 of the **Planning Statement [TR030008/APP/7.1]**.

3.1.2 In summary, there is an imperative and urgent need for the Project to provide port infrastructure for the import and export of liquid bulk energy products in the Humber to support the transition to net zero and the decarbonisation of the Humber industrial cluster and other locations.

3.1.3 The objectives of the Project, which partly arise out of that need, are then set out and explained. Finally, this chapter describes the alternatives that have been considered by Associated British Ports ("ABP") ("the Applicant") and indicates the main reasons for choosing the option that is now the Project, taking into account the effects of the Project on the environment.

3.1.4 The Applicant's responses to comments received during two rounds of statutory consultation relating to alternatives are set out in the **Consultation Report [TR030008/APP/5.1]**.

3.2 The Need for the Project

3.2.1 The NPSfP (Ref 3-1) establishes that there is a "*compelling need for substantial additional port capacity*" over the next 20–30 years (i.e. to 2032 - 2042), to be met by a combination of consented and new development (paragraph 3.4.16). The need for the specific infrastructure comprising the Project derives from the following inter-related factors:

a. The national need to provide port capacity.

b. The need for port capacity to serve the energy sector in the humber.

c. The need to achieve energy security through a diversity of technologies.

d. The urgent need to scale up hydrogen production capability.

e. The urgent need for carbon capture and storage ("CCS[1]") technologies.

3.2.2 The need for the Project is explained further below, commencing with consideration of the national need, then regional need and then specific technologies related to net zero.

[1] This chapter refers to carbon capture and storage ("CCS") and carbon capture, utilisation and storage ("CCUS") where appropriate. CCUS is the process of capturing carbon dioxide CO_2 emissions from fossil power generation and industrial processes for storage deep underground or re-use, such as creating synthetic fuel. CCS is the process of capturing carbon before it enters the atmosphere.

The national need to provide port capacity

3.2.3 There is an established national need for port operators and developers such as ABP to bring forward new port infrastructure in locations where it is required and in response to market demand, to provide additional capacity, create competition and build resilience in the sector and deliver wider economic benefits in the public interest.

3.2.4 The NPSfP (Ref 3-1) recognises the essential role that ports play in the growth of the UK economy and further notes that shipping will continue to provide the only effective way to move the vast majority of freight in and out of the UK, and the provision of sufficient sea port capacity will remain an essential element in ensuring sustainable growth in the UK economy (paragraph 3.1.4 of the NPSfP).

3.2.5 The Government seeks to encourage sustainable port development to cater for long-term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner, thus contributing to long-term economic growth and prosperity (paragraph 3.3.1 of the NPSfP).

3.2.6 A commercial decision has been taken to bring forward the Project in response to market demand at the Port of Immingham for the import and export of liquid bulks. This will increase port capacity and develop resilience, core objectives of the NPSfP.

The need for port capacity to serve the energy sector in the Humber

3.2.7 There is an imperative need for port infrastructure to provide capacity to serve the energy sector, for the import and export of liquid bulks relating to hydrogen and CO_2, to help achieve the 2050 legally binding net zero target.

3.2.8 There is a particular need for port infrastructure on the Humber, (one of the major industrial areas in the country, an important contributor to the national and regional economy and the industrial cluster emitting more CO_2 than any other industrial cluster in the country) to support decarbonisation in the region and elsewhere, to support the provision of alternative sources of clean energy locally (and to contribute to the national need) and to contribute to the regional and local economy. As shipping provides the most effective way to move hydrogen in the form of refrigerated ammonia in and out of the UK, sufficient port and landside infrastructure is required for ammonia storage and processing. Shipping of CO_2 also helps maximise the use of CCS infrastructure.

3.2.9 The role that ports play in the energy market is recognised at paragraph 3.1.5 of the NPSfP (Ref 3-1) which states that '*Ports have a vital role in the import and export of energy supplies' and that 'port handling needs for energy can be expected to change as the mix of our energy supplies changes and particularly as renewables play an increasingly important part as an energy source*". Paragraph 3.3.5 of the NPSfP (Ref 3-1) explains that the Government wishes to see port developments supporting sustainable development by providing additional capacity for the development of renewable energy.

The need to achieve energy security through a diversity of technologies, fuels and supply routes

3.2.10 There is an urgent need to achieve energy security through a diversity of technologies, fuels and supply routes. The UK is vulnerable to international energy prices and dependent on imported oil and gas. Government policy including that set out in the NPSfP (Ref 3-1), the energy National Policy Statements[2] ("NPSs"), the draft energy NPSs[3] and Powering up Britain 'Energy Security Plan' (March 2023) (Ref 3-12), demonstrates the need for new energy infrastructure including necessary import and export facilities at ports, responding to market demand and new technologies, in order to develop competition and diversity of supplies to help in the net zero transition. The need for energy security means that energy from a range of reliable renewable sources is required. The Government's 2050 net zero target underpins the urgency of bringing forward necessary infrastructure to facilitate the availability of clean energy as soon as possible in order to tackle climate change. In line with national policy, a range of technologies is required to be developed on the Humber to facilitate the production of low carbon hydrogen and the use of carbon capture, utilisation and storage ("CCUS") which has a wide range of applications which will support the transition to net zero. CCUS is likely to predominantly utilise renewable sources of energy and is complemented by other technologies such as gas-fired generation, which assists in maintaining a diversity of sources, and hence energy security.

3.2.11 The NPSfP (Ref 3-1) recognises the importance of ensuring security of energy supplies through ports and provides that ports will need to be responsive to changes in the different types of energy supplies needed (paragraph 3.1.5) and further at paragraph 3.3.3, the NPSfP (Ref 3-1) reiterates the need to ensure that new port infrastructure should ensure security of supply.

The urgent need to scale up hydrogen production capability

3.2.12 As part of the need to deliver energy security and decarbonisation, there is an urgent national need to scale up low carbon hydrogen production capability as an established alternative "clean" source of energy. Low-carbon hydrogen includes "green hydrogen" (hydrogen from renewable electricity) and "blue hydrogen" (hydrogen from fossil fuels with CO_2 emissions reduced by the use of CCS).

3.2.13 The UK Hydrogen Strategy (August 2021) (Ref 3-4) recognises the scale of the challenge to increase green hydrogen production, stating in Chapter 1 "*With virtually no low carbon hydrogen produced or used currently, particularly to supply energy, this will require rapid and significant scale up from where we are today"*. Paragraph 1.2 of the Hydrogen Strategy (Ref 3-4) emphasises the need for hydrogen infrastructure recognising that hydrogen can only be considered as a decarbonisation option if it is readily available. Paragraph 1.3 builds on this, stating *"as a result of its geography, geology, infrastructure and capabilities, the UK has an important opportunity to demonstrate global leadership in low carbon*

[2] Overarching National Policy Statement for Energy (EN-1) (July 2011) (Ref 3-5)
[3] Draft Overarching National Policy Statement for Energy (EN-1) (March 2023) (Ref 3-11)

hydrogen". Section 2.2 of the Hydrogen Strategy (Ref 3-4) outlines how hydrogen development can be delivered and scaled up, and states *"Investors, developers and companies across the length and breadth of the UK are ready to build if the policy environment is in place",* further stating at 2.4.2 that *"developing and scaling hydrogen power during the 2020s can reduce the burden on other technologies such as renewables, CCUS and nuclear".*

3.2.14 The British Energy Security Strategy (April 2022) (Ref 3-6) notes that the UK is well-placed to exploit all forms of low carbon hydrogen production and commits to 10GW of hydrogen production by 2030. The British Energy Security Strategy (Ref 3-6) seeks up to 1GW of electrolytic 'green' hydrogen and up to 1GW of CCS-enabled 'blue' hydrogen to be operational or in construction by 2025. It recognises that to accelerate our supply of low carbon hydrogen, it requires "*designing, by 2025, new business models for hydrogen transport and storage infrastructure, which will be essential to grow the hydrogen economy*".

3.2.15 Once fully constructed and operational, the Project could deliver 3% of the Government's 2030 10GW target for green hydrogen (300MW) and help meet the need for decarbonisation of industry including the heavy transportation sector.

The urgent need for carbon capture and storage technologies

3.2.16 There is an urgent national need for CCS technologies to support decarbonisation and therefore a need for CCS infrastructure, particularly in industrial areas such as the Humber where the need for decarbonisation is the greatest. CCS technology captures carbon dioxide from power generation, low carbon hydrogen production and industrial processes, storing it underground where it cannot enter the atmosphere. The Project would help maximise the potential of emerging CCS infrastructure in the Humber, particularly in relation to the Viking CCS project.

3.2.17 The Government's Net Zero Strategy Build Back Greener (October 2021) (Ref 3-13) sets out the Government's ambition to capture 20-30 Mt of carbon dioxide per year by 2030 and at least 50Mt by the mid 2030's. The Project can facilitate the import of up to nearly 10 Mt of Carbon dioxide, or one third of this objective.

3.2.18 Draft EN-1 (Ref 3-11) identifies the urgent need for new nationally significant CCS infrastructure for the transition to a net zero economy (paragraph 3.5.1). In paragraph 3.5.2, Draft EN-1 explains that the Government's Climate Change Committee has advised that new CCS infrastructure is a *"necessity not an option"* and that *"CCS infrastructure will also be needed to capture and store carbon dioxide from hydrogen production from natural gas, industrial processes, the use of bioenergy …. and from the air".*

3.2.19 Draft EN-1 (Ref 3-11) recognises the importance of ports to enable the transfer of carbon dioxide from onshore infrastructure onto ships and that the need for CCS infrastructure set out in Draft EN-1 is likely to be a relevant consideration.

3.2.20 The Project provides an opportunity to facilitate the use of CCS infrastructure, including in industrial locations which do not have direct access to CCS systems and develop wider economic opportunities, including inward investment related projects that will utilise the hydrogen and CCS infrastructure.

3.3 The Project Objectives

3.3.1 The objectives for the Project are as follows:

a. To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone;

b. To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH_3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist in the UK's transition towards net zero;

c. To deliver and operate new port infrastructure, and its first user's hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham;

d. To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community; and

e. To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

3.3.2 Objective (a) responds directly to the need identified above for new port infrastructure, capacity and resilience at a national and specifically Humber level. It leads to a requirement for a suitable marine site on the Humber with landside capacity for associated facilities, and proximity to local industry and potential customers.

3.3.3 Objective (b) addresses the particular need for infrastructure to import and export a range of liquid bulk energy products. Those include, but are not limited to, ammonia to produce green hydrogen and CO_2 to facilitate CCUS.

3.3.4 In order to facilitate the import and export of liquid bulk energy products including ammonia, the Project must be capable of receiving and discharging vessels of a variety of sizes. The dimensions of the largest vessel, very large gas carrier ("VLGC"), expected to be used to transport ammonia to and from the jetty would be approximately 250m in length, 45m beam and 12.8m draught. Accordingly, access to a deep-water port is required. These larger ships are required to optimise the shipping logistics and reduce the environmental impact of shipping.

3.3.5 Ammonia is a hazardous substance transported in refrigerated liquid form and, once imported, must be stored and treated in a way that limits the toxic risk that arises from it. The pipeline from the jetty to the ammonia storage tank represents the greatest risk of potential damage and/or accidental leakage. The further the ammonia is moved in pipes the greater the loss of refrigeration and the greater the energy use in maintaining the correct refrigeration temperature. As a result, the ammonia storage tank should be as close to the Terminal as possible.

3.3.6 In addition to proximity to industry and the proposed CCUS network, the Project also requires good connections to the transport network to facilitate the distribution of hydrogen to end customers in the heavy transport sector.

3.3.7 Objectives (c) to (e) relate to the impacts and benefits of the Project in order to address wider legislative and policy requirements.

3.3.8 In relation to Objective (c):

a. Paragraph 3.3.3 of the NPSfP (Ref 3-1) provides that, to help meet the requirements of the Government's policies on sustainable development, new port infrastructure should "*contribute to local employment, regeneration and development; ensure competition and security of supply; preserve, protect and where possible improve marine and terrestrial biodiversity; minimise emissions of greenhouse gases from port related development; be well designed, functionally and environmentally; be adapted to the impacts of climate change; minimise use of greenfield land; provide high standards of protection for the natural environment; ensure that access to and condition of heritage assets are maintained and improved where necessary; and enhance access to ports and the jobs, services and social networks they create, including for the most disadvantaged*."

b. Locally, the spatial development strategy of the North East Lincolnshire Local Plan (Ref 3-2) promotes sustainable development to "*improve the quality of life, bring forward quality development to meet identified needs and which delivers economic, social and environmental benefits*."

3.3.9 A suitable location for the Project therefore requires available land, water, transport and utility connections.

3.3.10 In relation to Objective (d):

a. At Paragraph 4.7.1, the NPSfP (Ref 3-1) requires that projects subject to the Environmental Impact Assessment ("EIA") Directive must be accompanied by an Environmental Statement describing "*the aspects of the environment likely to be significantly altered by the project*". Paragraph 4.7.2 of the NPSfP goes on to state that "*the decision-maker will find it helpful if the applicant also sets out information on the likely significant social and economic effects of the development*." The NPSfP also recognises at Paragraph 4.16.2 that "*Port developments can have direct impacts on health, including increasing traffic, air pollution, dust, odour, polluting water, hazardous waste and pests."*

b. In terms of health and safety in relation to pollution control, the NPSfP (Ref 3-1) explains at paragraph 4.11.2 that "*The planning and pollution control systems are separate but complementary. The planning system controls the development and use of land in the public interest. It plays a key role in protecting and improving the natural environment, public health and safety, and amenity, for example by attaching requirements to allow developments which would otherwise not be environmentally acceptable to proceed, and preventing harmful development which cannot be made acceptable even through requirements*".

c. Whilst not applicable to the determination of applications for nationally significant infrastructure projects, the North East Lincolnshire Local Plan (Ref

3-2) contains strategic policies to safeguard the built, historic and natural environment and more detailed policies that require the consideration of local amenity in terms of noise, air quality, traffic, vibration, dust and visual impact.

3.3.11 The ability to appropriately minimise impacts including on the health and safety of the local community therefore influences the identification of a suitable location of the Project.

3.3.12 In relation to Objective (e):

a. The Ten Point Plan (November, 2020) (Ref 3-8) sets out the Government's ambition for job creation in implementing measures to achieve net zero stating that "*This Ten Point Plan to get there will mobilise £12 billion of government investment, and potentially three times as much from the private sector, to create and support up to 250,000 green jobs*." The Ten Point Plan sets out that delivering the growth of low carbon hydrogen could deliver up to 8,000 jobs by 2030 with the potential to unlock 100,000 jobs by 2050 in a high hydrogen net zero scenario. Similarly investing in CCS could potentially deliver 50,000 jobs by 2030. The Energy White Paper (December 2020) (Ref 3-3) builds upon this ambition with an aim to "*establish the UK as a world leader in the deployment of CCUS and clean hydrogen, supporting 60,000 jobs by 2030*".

b. The Levelling Up the United Kingdom White Paper (Ref 3-7) identifies that the UK's transition to net zero is a future factor driving the UK's economic geography. Chapter 1.4.1 recognises that whilst the transition to Net Zero could be disruptive for places that need to undergo the largest transition (given the level of jobs in carbon-intensive industries), it could also be transformative. It states "*the 'Green Industrial Revolution' will require significant investment in new infrastructure and production processes using new technologies*". The White Paper also highlights how many places outside London and the South East have potential to build on their existing strengths such as *"renewable energy, electric vehicle manufacture, Carbon Capture, Utilisation and Storage, and hydrogen*".

c. Paragraph 3.3.1 of the NPSfP (Ref 3-1) advises that the Government seeks to "*encourage sustainable port development to cater for long term forecast growth in volumes of imports and exports by sea with a competitive and efficient port industry capable of meeting the needs of importers and exporters cost effectively and in a timely manner, thus contributing to long-term economic growth and prosperity; allow judgments about when and where new developments might be proposed to be made on the basis of commercial factors by the port industry or port developers operating within a free market environment; and ensure all proposed developments satisfy the relevant legal, environmental and social constraints and objectives, including those in the relevant European Directives and corresponding national regulations*."

d. Paragraph 4.3.2 of the NPSfP (Ref 3-1) recognises that at a regional and local level, "*economic benefits from port developments include regeneration and employment opportunities. As commercial developments, ports can also generate agglomeration effects by bringing together businesses, with varying*

degrees of mutual interaction, and producing economic benefits over and above those reflected in the value of transactions among those businesses." Furthermore, at paragraph 4.3.3, the NPSfP also recognises that "Ports *can contribute to the enhancement of people's skills and of technology, as embodied in equipment used by ports and port-related activities, with wider longer-term benefits to the economy*."

e. The North East Lincolnshire Local Plan (Ref 3-2) aims to encourage growth and ensure the Borough becomes a sustainable location in the future. The Foreword to the Local Plan sets out that North East Lincolnshire is entering a period of economic growth and that between 2013 and 2032 the Council plan to deliver 8,800 new jobs. It is further stated that a significant proportion of these will be focused around five key economic sectors which includes ports and logistics and renewable energy.

3.3.13 Taking into account the national and local policy above, the Project should seek to enhance the local and regional economy.

3.4 How the Project meets the objectives

3.4.1 A brief explanation is provided below of how the Project meets the objectives.

Objective (a): To provide essential port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone

3.4.2 The Project will provide additional capacity at the Port of Immingham to serve the energy sector, on the Humber, close to existing industries seeking to decarbonise and customers within the energy sector.

Objective (b): To provide capacity to support the import and export of a range of liquid bulk energy products including (i) ammonia (NH3) (to produce green hydrogen) to support the decarbonisation of industrial activities and in particular the heavy transport sector and (ii) carbon dioxide (CO_2), to facilitate carbon capture and storage, both of which will assist the UK's transition towards net zero.

3.4.3 Air Products BR Ltd ("Air Products") would be the first user of the Terminal, importing ammonia for processing to hydrogen at a new hydrogen production facility forming part of the Project. Immingham is a deep-water port and therefore suitable for the very large gas carriers used to import ammonia. The Project also allows the construction of the ammonia storage tank in close proximity to the Terminal, minimising the length of pipeline being used to transport the ammonia, and a suitable distance from non-industrial and residential land uses.

3.4.4 Air Products initially intends to produce the ammonia at NEOM in Saudi Arabia where wind and solar energy is abundant. The production plant is under construction and is anticipated to be operational in 2027, such that ammonia imports from NEOM are anticipated to be received in northern Europe in 2027. Other import terminals in Europe are also under development in Rotterdam and Hamburg and those terminals are planned to be operational by this time. Air

Products is also considering additional locations for the production of ammonia including Oman.

3.4.5 The first phase of the Project (including the jetty and all necessary buildings and structures to render the hydrogen production facility operational) is planned to commence in early 2025 (subject to obtaining necessary consents) and last for between two and a half and three years – at which point ammonia will be available from NEOM. The opportunity to secure the benefits arising from the production of hydrogen will arise on completion of the first phase and the Applicant and Air Products are working together in order to ensure that those benefits can be delivered as early as possible.

3.4.6 As set out in **Chapter 1: Introduction [TR030008/APP/6.2]**, the Project is anticipated to produce up to 300 MW of hydrogen per annum once fully built out and operational. Depending on market demand, this could meet up to 3% of the Government's hydrogen production target. The Project would therefore make a contribution to the Government's aim of achieving 10GW of low carbon hydrogen production capacity by 2030, as defined in the British Energy Security Strategy (Ref 3-6).

3.4.7 The hydrogen produced could be used for general industrial uses on the Humber, helping to decarbonise heavy industry in one of the UK's main industrial clusters and CO_2 emitters. Neighbouring sites could take the hydrogen directly via new pipelines which could be separately consented.

3.4.8 In particular, the Project would contribute to the decarbonisation of hard to abate transport emissions. Immingham provides easy and central access to the UK's road network to facilitate wider distribution of liquidised hydrogen. By way of context, if all the hydrogen produced was used to fuel Heavy Goods Vehicles ("HGVs"), in substitution of other fuels used in road transport, this could eliminate approximately 704,634 tonnes of greenhouse gas emissions each year, totalling 21,757,414 tonnes over 25 years. (see **Chapter 19: Climate Change [TR030008/APP/6.2]** for the impact on greenhouse gas emissions).

3.4.9 As set out in **Chapter 2: The Project** of this ES **[TR030008/APP/6.2]**, the Terminal would operate 24 hours a day, seven days a week and 365 days a year. It is anticipated that around 12 of the vessel calls would be associated with the hydrogen production facility. The remaining jetty capacity provides substantial flexibility for any expansion by Air Products or import/export of other liquid bulk energy products, including in connection with the carbon capture sector.

3.4.10 The location of the Project would enable it to support the delivery of CCUS. The developer of the Viking CCS project (Harbour Energy) and ABP are collaborating around the potential to develop a facility for the discharge of liquefied CO_2 cargoes from vessels at the Terminal into the Viking CCS project infrastructure for storage. The Project could facilitate the transfer of liquified CO_2, from dispersed industrial and power industries along the coast which do not have direct access to the Viking CCS pipeline.

3.4.11 The facilities for landside connection of the Terminal to the Viking CCS pipeline would require separate future consents as necessary. However, the Project reserves a pipeline corridor from the Terminal to the public highway in order to facilitate future connections.

3.4.12 Future energy cargoes that would contribute to the transition to net zero would also be accommodated and enable the port developer to have available port infrastructure and capacity in place to respond speedily to new technologies and requirements. This market led approach accords with the NPSfP (Ref 3-1) which seeks to enable the ports industry to respond to the needs of the market but in a way that delivers sustainable development.

Objective (c): To deliver and operate new port infrastructure, and its first users hydrogen production facility, in a safe, efficient and sustainable manner by making effective use of available land, water, transport and utility connections which exist in and around the Port of Immingham.

3.4.13 ABP and Air Products have sought to minimise land take, using no more land than is necessary to deliver the Project. Part of the Project is located on land allocated for development within the North East Lincolnshire Local Plan (ELR001 is a strategic proposed employment allocation for the ports and logistics sector on Kings Road and ELR025a is a site reserved for long term business expansion) (Ref 3-2).

3.4.14 **Section 3.8** provides more detail on the water, transport and utility connections that are available to the Project at the Port of Immingham.

Objective (d): To minimise adverse impacts on the environment and safeguard the health, safety and amenity of the surrounding community.

3.4.15 The Applicant has minimised the impacts of the Project to appropriate levels through the process of scheme design and environmental assessment. The likely significant environmental effects of the Project, including noise, air quality, landscape and visual, socio-economics and health, have been assessed and reported in this ES.

3.4.16 **Chapter 26: Summary of Likely Significant Effects [TR030008/APP/6.2]** summarises the outcomes of the EIA. The number of residual significant adverse effects is relatively limited in scale and local in nature and relates to:

a. Landscape character to the Site and its immediate setting during construction;

b. The views of recreational users of Bridleway 36 and the proposed England Coast Path at two viewpoints during construction and operation, and residential receptors at Queens Road at one viewpoint during construction;

c. The loss of residential properties on Queens Road;

d. The loss of part of the Long Strip woodland during construction;

e. In-combination effects to residential and commercial properties on Queens Road, Bridleway 36 and the proposed English Coast Path and the Long Strip woodland; and

f. Cumulative effects relating to landscape effects to the site and surrounds during construction, visual effects on three viewpoints at construction and two viewpoints at operation.

3.4.17 Importantly, the assessment also identifies that there are significant beneficial effects relating to a reduction in greenhouse gas emissions during operation,

employment creation and generation of gross value added, including cumulative benefits when considered in conjunction with other developments.

3.4.18 A number of temporary, short-term significant effects are reported during the construction stage in relation to noise and vibration, terrestrial ecology, traffic and transport and landscape and visual. These effects will be managed through controls set out in the Development Consent Order ("DCO") including the Construction Environmental Management Plan that will be based on the **Outline Construction Environmental Management Plan [TR030008/APP/6.5]** which accompanies the Application for development consent.

3.4.19 The Project also requires a Hazardous Substance Consent from North East Lincolnshire Council and will be regulated in accordance with the The Control of Major Accident Hazard ("COMAH") Regulations 2015 (Ref 3-14).

3.4.20 In terms of health and safety, **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** concludes that, although it is not possible to eliminate risks entirely, risks can be appropriately managed by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to achieve a level as low as reasonably practicable, as required by the COMAH Regulations (Ref 3-14). Therefore, the Project would comply with all relevant safety and environmental legislation for the management of risks on industrial facilities, from the design and construction phase, through operation and eventual decommissioning.

3.4.21 Control during operation will be via an Environmental Permit, which would only be granted by the Environment Agency when they are confident that the Project has been designed in accordance with Best Available Technology ("BAT").

Objective (e): To enhance both the local and regional economy through direct investment in and around the Port of Immingham and by partnering with the supply chain, provide opportunities for training, upskilling, apprenticeships and local employment.

3.4.22 The Project is anticipated to provide an average of 627 net jobs during the construction period, with the likely peak workforce anticipated to be 1,012 jobs during Phase 1 (792 landside jobs and 220 marine jobs). During operation, the total net employment is anticipated to be 207 jobs.

3.4.23 The gross value added (growth added through employment opportunities) during the construction period is £35m, of which over £24m is projected to remain in North East Lincolnshire.

3.4.24 Support for the generation of local employment opportunities has been evidenced during pre-application consultation and is considered further in the **Consultation Report [TR030008/APP/5.1]**.

3.4.25 Post consent, opportunities to partner with the supply chain, provide training and recruitment opportunities working with local organisations such as CATCH will be considered further to provide opportunities for skills and training in the local area.

3.5 Alternatives

3.5.1 This section has been prepared to address the requirements of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) ('the EIA Regulations') (Ref 3-9). These state at Regulation 14(2)(d) that the Environmental Statement should contain *"a description of the reasonable alternatives studied by the application, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment"*. Paragraph 2 of Schedule 4 'Information for Inclusion in Environmental Statements' of the EIA Regulations requires inclusion of *"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects"*.

3.5.2 Paragraph 4.9 of the NPSfP (Ref 3-1) sets out that whilst *"the relevance or otherwise to the decision-making process of the existence (or alleged existence) of alternatives to the proposed development is in the first instance a matter of law, detailed guidance on which falls outside the scope of this NPS".* Further, *"From a policy perspective this NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option."*

3.5.3 It acknowledges however the above requirement to include in the ES factual information about the main alternatives which have been studied and notes that this should include "*an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility"* (paragraph 4.9.2 of the NPSfP) (Ref 3-1).

3.5.4 The NPSfP (Ref 3-1) also notes that, in some circumstances, there are specific legislative requirements, notably under the Habitats Directive (Ref 3-15), for the Applicant and decision-maker to consider alternatives and "*these should also be identified in the ES by the applicant*". In the case of this Project, as set out in the **Shadow Habitats Regulation Assessment ("HRA") [TR030008/APP/7.6],** it has been concluded that the Project has no adverse effect on the integrity of protected sites and therefore there is no reason to consider alternatives. However, a **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** has been submitted to address the possibility that the Secretary of State's Appropriate Assessment reaches a different conclusion.

3.5.5 This chapter of the ES and the **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** both consider alternatives; however, it should be noted that:

a. This chapter of the ES describes reasonable alternatives that have been studied by ABP and the main reasons for choosing the proposed development having regard to environmental impacts, in accordance with Regulation 14 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 3-9); and

b. The **Without Prejudice Shadow HRA Derogation Report [TR030008/APP/7.3]** goes further, demonstrating that there are no alternative solutions to the Project as proposed and, that there are imperative reasons of overriding public interest for the project to proceed and compensatory measures which shall be secured (if required).

3.5.6 The following sections of this Chapter therefore address the reasonable alternatives considered by the Applicant in relation to location of the Project and design evolution (by reference to size, scale, design and environmental effects of the Project). It also addresses the main reasons for selecting the Project by reference to those factors.

3.5.7 In order to ensure a robust assessment of the likely significant environmental effects of the Project, the EIA has been undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate. This involves assessing the maximum (or where relevant, minimum) parameters for the elements where flexibility needs to be retained (dimensions or operational modes for example). As such, this ES represents a reasonable worst-case assessment of the potential impacts of the Project at this current stage of design.

3.5.8 The consideration of alternatives and design evolution has been undertaken in the context of selecting the location of the Project with the aim of avoiding and/ or reducing adverse environmental effects where appropriate (following the mitigation hierarchy of avoid, reduce and, if possible, remedy), while maintaining operational efficiency and cost-effectiveness, and considering other relevant matters such as available land and planning policy.

3.5.9 The steps involved in the consideration of alternatives are as follows:

a. Step 1 – Consideration of the broad options, i.e., whether to build or not to build the Project in the Humber.

b. Step 2 – Consideration of other port locations around the Humber Estuary, concluding that the Port of Immingham is an appropriate place.

c. Step 3 – Consideration of the appropriate location for the Project within the Port of Immingham.

d. Step 4 – Design refinement, taking into account site constraints and the need to minimise harm to the extent appropriate.

3.5.10 Further detail in relation to these steps is set out below.

3.6 Step 1 - Consideration of the broad options

3.6.1 Step 1 of the assessment of alternatives considers the broad options, either to do nothing or to develop the Project outside of the Humber. The consideration of alternative technologies for hydrogen production is also considered.

Option 1 - Do nothing

3.6.2 If the Project were not constructed, the consequence would be that the need for the Project and the Project objectives would not be met. This would mean that the demand from the energy sector for port infrastructure to help meet the Government's net zero obligations and the decarbonisation of the Humber Estuary would not be met.

3.6.3 The do nothing alternative would also mean that a UK first of a kind Green Energy Terminal including facilities to enable production of green hydrogen from ammonia would not be developed, with the result that a key development to assist the UK in meeting its net zero target by 2050 would not be brought forward. For these reasons, the do-nothing scenario is not considered appropriate.

Option 2 – Development outside of the Humber

3.6.4 The development of the Project at a location outside of the Humber Estuary is not and cannot be an alternative solution to meeting the identified need, given that a primary objective for the Project is the provision of additional capacity within the Humber. Consequently, locating the facility outside the Humber would mean that the need and objectives which have been identified would not be met.

3.6.5 The NPSfP (Ref 3-1) sets out that '*suggested alternative proposals which mean the primary objectives of the application could not be achieved … can be excluded on the grounds that they are not important and relevant to the decision*' and therefore, the option to develop the Project outside of the Humber has been discounted.

Option 3 – Alternative technologies for hydrogen production

3.6.6 The need for a green hydrogen production facility was identified as an essential part of the Project at an early stage, to align with the Government's ambition to scale up low carbon hydrogen production during the 2020s, deliver 10GW of low carbon hydrogen by 2030 and to help decarbonise heavy industry and in particular the UK transport sector.

3.6.7 Large scale global deployment of refrigerated green ammonia is emerging as the safest and most efficient way to transport bulk quantities of green hydrogen from world locations where sustainable solar and wind energies are more available than in the UK. While transport of green hydrogen could be achieved in other ways, such as direct shipping of hydrogen, the transport risks, costs and scale achievable make alternative transport methods less viable.

3.6.8 Facilities to store ammonia and subsequently produce and temporarily store green hydrogen from the ammonia are therefore required. Whilst hydrogen can be produced using locally sourced renewable energy, this would require a greater number of new wind and solar farms to be constructed (whose operation is weather dependant and therefore more intermittent in the UK), with the associated land take. There would also be requirements for higher quality, potable water. The technology proposed is considered suitable in terms of its environmental impact, efficiency and the technical maturity of the technology.

3.6.9 Critically, however, the Project responds to a policy need for a range of hydrogen production facilities to come forward encompassing different technologies and therefore alternatives to the production of low carbon hydrogen from ammonia are not considered further.

3.6.10 The final decision has not yet been made on the detailed design of the hydrogen production facility. The proposed parameters for the Project reflect the necessary scale of the Project in terms of land requirements and heights following preliminary design and engineering work but incorporate a degree of flexibility in the dimensions and configurations of buildings and structures to facilitate the final detailed design.

3.7 Step 2 - Consideration of alternative port locations within the Humber Estuary

3.7.0 Step 2 of the assessment of alternatives identifies a list of potential locations which could potentially meet the Project objectives of providing port infrastructure, capacity and resilience to support the growth and changing strategic needs of the energy sector to support decarbonisation within the Humber Industrial Cluster and the Humber Enterprise Zone and to provide capacity to support the import and export of a range of liquid bulk energy products in the form of the additional berth capacity and landside storage and processing facility.

3.7.1 In identifying alternative locations, it is first necessary to understand the principal requirements for the Project to ensure that the identified need and objectives of the Project are met. As identified above, these are:

a. Suitable marine access;

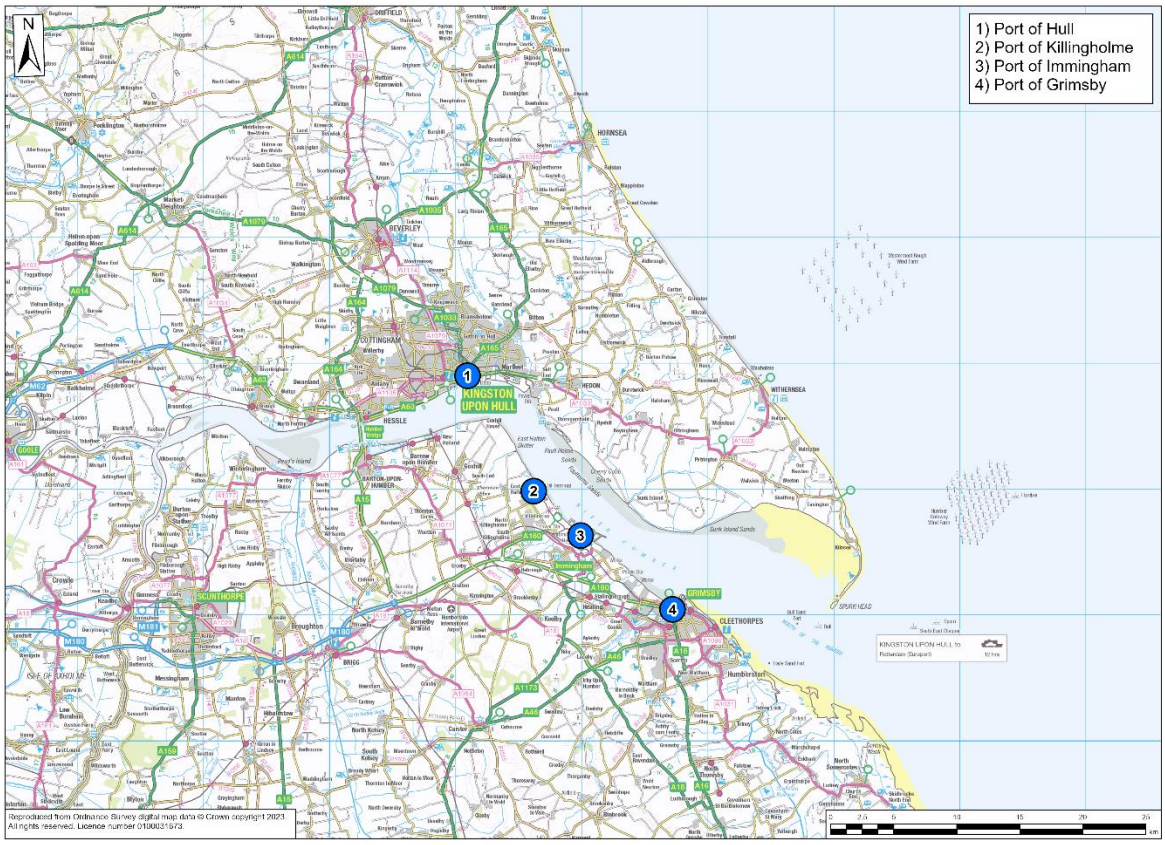
b. Suitable berth location and capability;

c. Available and suitable land for storage and processing capability; and

d. Suitable transport connections.

3.7.2 The Humber Estuary is centrally located on the eastern UK coastline and has the deepest water between the River Thames and the River Tees. **Plate 3-1** identifies the existing Port locations within the Humber Estuary which include the Port of Immingham, the Port of Hull and the Port of Grimsby and a smaller port at Killingholme.

Plate 3-1: Existing Port location within the Humber Estuary



Suitable marine access

3.7.3 As explained above, the new liquid bulk import and export capacity has to be in a location within the Humber Estuary where it can be accessed by the VLGC vessels typically used to import and export liquid bulks.

3.7.4 This means that the proposed jetty must be able to accommodate a maximum sized vessel with a length overall ("LOA") of approximately 250m, beam of 45m and a draught of 12.8m (referred to as the 'design vessel'). In addition, the facility needs to have capability to support smaller vessels, to provide flexibility.

3.7.5 When considering viable locations within the Humber Estuary, the starting premise from a marine accessibility point of view is prevailing water depths. The Humber is an estuary with a tidal range that varies from approximately 6m to 7m. It also has natural and stable deep-water channels which have largely dictated the locations where port facilities have been developed.

3.7.6 Having regard to the vessel design parameters, a berth pocket of around 14m below Chart Datum is required to keep these vessels afloat at low water. Movements would be restricted by tides, with the Humber's main fairways only navigable for deep sea shipping at high water periods – bearing in mind its 6/7m tidal range. Smaller merchant vessels with shallower drafts would cope better with the Humber's main channels at times other than high water, with coastal vessels accessing the ports of Immingham and Hull at all states of the tide. Given

the need for the Terminal to operate at all hours and receive a large number of vessel calls, this factor is important, particularly for CO_2 transfer operation.

3.7.7 A review of the bathymetry of the estuary demonstrates, as shown in **Figure 3.1 Water Depths of 7m Below Chart Datum [TR030008/APP/6.3]** that there are very few potential sites which meet this marine access requirement and affords sufficient navigability and manoeuvrability.

Suitable berth location and capability

3.7.8 None of the 'in dock' port areas along the Humber Estuary (located at the ports of Grimsby, Immingham Hull and Killingholme) would be able physically to accommodate the design vessel specified above. The lock entrances into these in dock areas are not big enough to accommodate such a vessel. On this basis, additional berth capacity able to accommodate the design vessel would need to be located at an 'in river' lock free location.

3.7.9 Furthermore, the water depths at all "in river" locations upriver from Immingham are not sufficiently deep to allow navigation of the design vessel at sufficiently large portions of the tidal cycle for operational flexibility, without a substantial programme of capital dredging.

3.7.10 A single berth able to accommodate the design vessel is required, but the berth should also accommodate smaller vessels for flexibility.

3.7.11 There is existing liquid bulks infrastructure at the Port of Immingham, but it is not suitable for the handling of bulk ammonia, in terms of equipment capability and compatibility with other products already handled. The existing infrastructure is also at capacity in regard to both throughput, berth availability and storage and is not necessarily available nor has the flexibility to be available at the times required for the ammonia process i.e. it cannot be relied upon to be available at the times needed by Air Products. In order to provide the berth availability, berth capacity and operational functionality required for ammonia import and CO_2 import/export, it is therefore necessary to develop new berth infrastructure within the Port of Immingham. The location and definitions of this new infrastructure within the Port of Immingham are discussed in Step 3 below.

Available and suitable land for storage and processing capability and suitability

3.7.12 As explained above, liquid bulk berth capacity has to be supported by landside connections and tankage located as close as possible to the berths to enable efficient and effective transfer and storage of the cargo. If the tankage is located too far from the berth and/or separated from other related operational areas by other uses, then it becomes increasingly complex and costly - and consequently less feasible - to transfer the cargo to the storage tank.

3.7.13 Sufficient land is also required for the construction of the hydrogen production plant in close proximity to the ammonia storage, to minimise transport of the product to the process infrastructure for reasons of safety.

3.7.14 Air Products has determined that the new berth would need to be supported by approximately 30 hectares of for land for storage, hydrogen production operations and administrative activities. That land must be in close proximity to the jetty.

3.7.15 In terms of the suitability of the landside area for storage and processing, both the tankage and process infrastructure are industrial in character and aesthetic and therefore should be located in an industrial environment. The Port of Immingham already has several developments of very similar nature within its boundaries and the area immediately around the port is home to similar large-scale oil refining, chemical manufacturing and power generation infrastructure.

Suitable transport connections

3.7.16 In order to facilitate the onward transport and distribution of green hydrogen to customers in the UK from this central location the Project needs to be in a location that benefits from good road access (suitable for HGVs) both in terms of local access (i.e. from the port facility to the strategic network) and strategic access (i.e. good accessibility on the strategic network between the port location and the source of destination).

Alternative port locations within the Humber Estuary

3.7.17 The following Port locations have been considered by ABP as potential alternative locations for the Project, against the principal requirements:

a. Port of Hull;

b. Port of Grimsby; and

c. Port of Killingholme.

3.7.18 Other locations within the Humber Estuary are not considered suitable due to:

a. the lack of suitable marine access - for example, providing a facility further upstream of the main Port of Hull complex for use by the type of vessels envisaged would require a very significant capital dredge within the Humber Estuary; and

b. the undeveloped nature of the location – where, in addition to any marine dredge requirements, it would be very challenging to create a new port facility with the necessary suitable landside facilities and connections.

3.7.19 Further analysis of the initial locations identified above against the requirements identified in the preceding paragraphs and environmental considerations has then been carried out. This analysis is reported in the following paragraphs.

3.7.20 For each of the locations identified, the provision of a potential solution to meeting the need would require the provision of new marine infrastructure and/ or dredging within the Humber European Marine Site (“EMS”) (consisting of the Humber Estuary Special Conservation Area (“SAC”), Special Protection Areas (“SPA”) and Ramsar site). As such, no distinction has been made in respect of the implications for the Humber EMS.

3.7.21 Only if more than one of the locations is deemed capable of providing an initial solution to meeting the need is it considered necessary to then look at this issue in further detail.

Port of Hull

3.7.22 The Port of Hull is owned and operated by ABP. The river frontage at the main port complex at Hull is located in a part of the Humber Estuary where consistent minimum water depths of 10m below chart datum are maintained (over high water periods), this is substantially less than the water depths required to allow navigation at most tidal states.

3.7.23 From a review of the current land use and activities within the Port, however, ABP consider that the only potential location for a new river frontage liquid bulk facility would be at the eastern end of the port estate close to Saltend Power Station. A substantial quantity of dredging would still be required to enable such marine infrastructure to operate and provide navigational access in water depths of around 14m (over high water) from downstream reaches of the Humber.

3.7.24 However, even if a marine facility of suitable scale could be developed in the location identified in an acceptable way, there is insufficient appropriately located land that is available or could be made available in and around the port estate to provide the necessary supporting landside facilities. The land immediately to the rear of the location identified is either in existing port use and subject to existing long term user agreements or is development land identified by ABP for use by other existing important port activities. The landside facilities need to be situated in close proximity to the jetty to minimise the length of pipework for the operations to be undertaken efficiently. Introducing longer sections of pipes increases operational demands and reduces efficiency.

3.7.25 A further issue is that, through its position on the north bank of the Humber, a facility at Hull is not as well located in terms of the relevant hinterland as, a facility on the south bank of the Humber. Air Products, whose specific requirements are a key aspect of the overall need identified, have confirmed to ABP that the Port of Hull, even if it were possible to provide what was physically required, does not represent a location able to satisfactorily meet its requirements as the depth of water is not sufficient and there is an absence of land necessary for the landside facilities.

3.7.26 Having regard to the requirements outlined earlier and the analysis undertaken, it has been concluded that the Port of Hull is not a suitable alternative as it would not be able to provide a solution to meeting the project need and objectives which have been identified.

Port of Grimsby

3.7.27 The Port of Grimsby, owned and operated by ABP, does not currently handle liquid bulk cargo, but is rather a facility that handles automotive cargo, is a major hub for the offshore wind industry and services the fishing and food industries.

3.7.28 The entrance into the commercial docks at Grimsby is located, via the existing Grimsby approach channel, a significant distance from that part of the Humber Estuary where consistent minimum water depths of 14m below chart datum are maintained. The approach channel to the Port of Grimsby is advertised at a depth of 2m below chart datum and, therefore, does not currently provide sufficient water depths to be able to accommodate the VLGC design vessel at any state of the tide. A significant deepening of some 8m (and therefore also widening) of this existing marine access channel would be required in order to provide the necessary marine access for the VLGC design vessel to access the river frontage at the Port of Grimsby at high water periods.

3.7.29 Although no detailed modelling or calculations have been undertaken, it is estimated that such deepening of the approach channel to the Port of Grimsby would alone require the removal in excess of 5 million cubic metres of material. Furthermore, once created a channel of such a depth and length would, as a result of the dynamic nature of the estuary in this location, be very difficult to maintain. Very frequent maintenance dredging of the channel would be necessary.

3.7.30 In addition to this fundamental issue, ABP does not consider that there is a suitable location along the river frontage at Grimsby where new marine infrastructure could be developed to provide the additional berth identified as the minimum requirement. Even if a suitable location could be found, further localised dredging would be required to enable such newly created river berths to be developed and to continue to operate.

3.7.31 The Port does have existing ‘in river’ berths, in the form of the Grimsby River Terminal that provides two main berths. These berths, however, still lie in insufficiently deep water and would require substantial capital dredging. They are also not, in their own right, sufficient to meet the amount of additional berthing considered to be required since these berths are already utilised by vessels that import trade cars and vehicles, which is a key trade for the Port of Grimsby.

3.7.32 Even if, however, these significant marine access constraints could be overcome there is insufficient appropriately located landside space available or able to be made available at the Port of Grimsby to support the required level of additional marine capacity identified as being required. The land that is potentially available is spaced out around the Port estate and is therefore not suitable for the development of marine infrastructure nor for the hydrogen production facility, due to the insufficient size and discrete nature of the land parcels, and their close proximity to commercial and residential property. Available land is not, therefore, sufficient to meet the need which has been identified.

3.7.33 Having regard to the requirements outlined earlier and the analysis undertaken, the Port of Grimsby would not be able to provide a solution to meet the need and objectives which have been identified.

Port of Killingholme

3.7.34 The Port of Killingholme, operated by CLdN Ports Killingholme, is an existing established facility with six berths that handles both Ro-Ro freight cargo (both accompanied and unaccompanied cargo) as well as trade vehicle imports.

3.7.35 From available information, it is understood that five of the six available berths at the Port of Killingholme are currently heavily used, and that one berth that is currently unused is within the fabric of the active Ro-Ro terminal and is wholly unsuitable for use by VLGC-type vessels.

3.7.36 Even if, however, these significant marine access constraints could be overcome there is insufficient appropriately located landside space available or able to be made available at the Port of Killingholme to support the required level of additional marine capacity identified as being required. The land that is potentially available is spaced out around the Port estate and is therefore not suitable for the development of marine infrastructure nor for the hydrogen production facility due to the dispersed nature of the potentially available land. Available land is not, therefore, sufficient to meet the need which has been identified.

3.7.37 In addition to the above matters, large parts of the Port of Killingholme form part of the site on which there is an existing Development Consent Order approval for a thermal generating station Nationally Significant Infrastructure Project – the North Killingholme Power Project. This project was approved in 2014 with non-material amendments subsequently approved in 2021. Commencement of the development is required to have begun by 2 October 2026.

3.7.38 As well as the above DCO consent, a 28-hectare area of the south / south-western part of the facility (including areas which overlap with the above DCO consent) and adjacent land benefit from planning permission granted in November 2021 for the construction of an additional vehicle storage area and associated on-site infrastructure (North Lincolnshire Council planning application reference PA/2020/1483).

3.7.39 Furthermore, as set out in Appendix D of the **Planning Statement [TR030008/APP/7.1]**, there are other Nationally Significant Infrastructure Projects in the vicinity of the Port of Killingholme, including the already consented Able Marine Park and the Humber Low Carbon Pipelines NSIP which is due to be submitted to the Planning Inspectorate in Q3 2023. As such, there are limited opportunities for development within close proximity of the Port of Killingholme.

3.7.40 For the reasons summarised it is not considered able to provide a solution to the specific, immediate and pressing need and objectives which have been identified.

Step 2 Conclusions

3.7.41 From the analysis carried out, which is summarised in the preceding paragraphs, the conclusion reached by ABP is that the only potential solution to meeting the Project need and objectives is the provision of a new multi-user green energy terminal at the Port of Immingham.

3.8 Step 3 - Consideration of the Project location at the Port of Immingham

3.8.1 Step 3 of the assessment of the alternatives considers the location of the jetty and associated landside infrastructure at the Port of Immingham. This has taken into account the Project objectives that relate to making effective use of available land, water, transport and utility connections in and around the Port of Immingham.

Location of the jetty at the Port of Immingham

3.8.2 Development within the current operational boundaries of the Port of Immingham is heavily constrained by existing infrastructure, including on the marine side by existing jetties and on the landside by both operational buildings and structures and an extensive network of pipelines and other services, both above and below ground.

3.8.3 There is no spare capacity on the existing deep-water jetties at the Port of Immingham to facilitate the import and export of additional liquid bulk cargoes and therefore a new jetty is required.

3.8.4 Placing new marine infrastructure significantly further to the east of the Port of Immingham, for example, much further to the east of the Immingham Oil Terminal, would not be feasible. The distance to the deep water channel is greater, meaning that the provision of any marine infrastructure would require either a longer jetty approach to reach the deeper water (which would increase Project cost and technical complexity, and present challenges relating to navigation and associated operations of adjacent facilities), or a large capital dredging programme in order to berth vessels closer to the shoreline (which would have adverse environmental and economic consequences) and also have adverse effects on operations of adjacent facilities.

3.8.5 Furthermore, river frontage areas to the west of the Immingham Oil Terminal are heavily developed. There is a proposal to develop this area as a new Ro-Ro facility, known as the Immingham Eastern Ro-Ro Terminal. Unlike a liquid bulk operation, a Ro-Ro facility has to be able to operate to a timetable, and therefore needs marine accessibility at all states of the tide. Deep sea access is therefore required so that the shallower drafted Ro-Ro vessels can still access their berths over low water periods just as easily as they can over high water periods. Therefore, this area is not available.

3.8.6 It is therefore necessary to locate the new jetty outside the existing operational Port, but as close to it as possible to benefit from the existing deep water approach channels, supporting infrastructure and port services, and also in a location with sufficient land to support the establishment of a new pipeline corridor and storage and production facilities.

3.8.7 The preferred jetty location lies to the east of the Port (to the immediate east of the Immingham Oil Terminal Jetty), since this is the only location that provides sufficient space for navigation and manoeuvring of the design vessels without severe impact on the adjacent facilities, and also provides adequate connection to sufficient landside area for development of the hydrogen production facility. In addition, the chosen location places the jetty outside the widest intertidal areas, reduces the capital dredge for the berth and should minimise the requirements for ongoing maintenance dredging.

3.8.8 The proposed jetty location, just to the east of the existing boundary of the Port, is therefore considered to be the most suitable for the Project, given the need to reach the deep-water channel.

3.8.9 Whilst the location provides suitable land for the hydrogen production facility as explained below, it also benefits from allocated land for future expansion.

Location of the hydrogen production facility at the Port of Immingham

3.8.10 Having identified the location of the jetty, a suitable location for the ammonia storage and hydrogen production facility was considered taking into account available space proximate to the jetty, the Port's existing development plans, ground conditions, presence of existing structures and services including existing transport corridors and proximity to residential conurbations.

3.8.11 The East Site and the West Site were selected as suitable for the following reasons:

a. They are predominantly brownfield sites suitable and available for the hydrogen production facility including land for terrestrial pipelines to connect to the pipelines on the jetty trestle;

b. The West Site is allocated for employment use in the North East Lincolnshire Local Plan;

c. They are close to the jetty to minimise onshore transport distances for ammonia, for safety reasons and to minimise heat leak;

d. There is a limited residential population in the vicinity;

e. Ground conditions are suitable for installation of process plant; and

f. There is local access to existing gas and grid connections and HGV access to the strategic road network.

3.9 Step 4 – Design Refinement

3.9.1 Step 4 of the assessment of alternatives sets out the design refinements that have been undertaken to minimise adverse impacts on the environment.

3.9.2 It is highlighted in paragraph 4.10.3 of the NPSfP (Ref 3-1) that, given the importance which the Planning Act 2008 (Ref 3-10) places on good design and sustainability, *"the decision maker needs to be satisfied that port infrastructure developments are sustainably designed and, having regard to regulatory and other constraints, are as attractive, durable and adaptable … as they can be"*. The design of the Project has been informed by relevant standards and guidelines for port infrastructure to ensure they are fit for purpose. Chapter 7 of

the **Planning Statement [TR030008/APP/7.1]** identifies where opportunities have been taken to incorporate sustainable design features into the Project.

3.9.3 The design of the Project has evolved in response to feedback from statutory consultation and the EIA. The following paragraphs set out the design refinements considered in respect of the Project.

Consideration of alternative jetty layouts

3.9.4 The jetty design has been informed through iteration and has evolved over the design stage of the Project. Initial designs identified that there was an underlying basic arrangement of the jetty which would be incorporated across all options; the requirement for a 1.1 to 1.2km approach jetty that crosses the southern shore of the Humber to a jetty head situated in, or adjacent to the natural deep water channel of the Humber Estuary. The use of the adjacent Immingham Oil Terminal for access was also considered however discounted due to the required design life of the Project.

3.9.5 The consideration of options therefore focused on the variations to the jetty head and presented a number of layouts as part of a longlist. The alternative designs were driven by the potential flexibility of the berth to accommodate future users, including a variety of vessel sizes, the number and spacing of berths, safety exclusion zones and clearance from adjacent facilities. At the time of long listing options a number of assumptions were adopted based on uncertainties over proposed design, e.g. required exclusion zones, future vessels and “ship fit[4]” requirements on a single berth.

3.9.6 Preliminary Navigation Simulation (“NavSim”) was undertaken to shortlist three of these options. This assessed each option in terms of vessel interaction with the jetty head, tidal flow, safety, and the operation of the layout with other maritime traffic. The requirement for capital and maintenance dredging was also considered at the longlist stage, considering both the environmental and economic effects of different dredge requirements. No major navigation hinderances to any option development was reported from the NavSim models.

3.9.7 With the location of the jetty head confirmed there was a review of the jetty approach within the envelope of the works area (Work No. 1). Various options were considered for the approach jetty, with respect to alignment, pile size and diameter and deck span. Alternative approach jetty designs have been tested, with estuarine flow modelling undertaken to assess the direct and indirect loss of intertidal habitats. This was used to identify the approach jetty parameters that would result in the smallest environmental impact on the European Marine Site.

Consideration of layout of hydrogen production facility

3.9.8 A primary consideration for the layout of the facility is the construction of the ammonia storage tank as close as possible to the jetty (and so as to facilitate as

[4] Ship fit studies relate to the assessment of the berth infrastructure and appurtenant equipment to ensure its disposition and arrangement is safe, suitable and robust for the proposed operations for the given range of vessels to be accommodated, under the design conditions determined"

direct a pipeline connection as possible) and an appropriate distance from non-industrial, including in particular residential, land uses.

3.9.9 Whilst the assessment of the Project is based on parameters to allow for design refinement and finalisation, detailed consideration has been given to the potential layout of the hydrogen production facility to ensure that it is deliverable within those parameters and will be functional and efficient from an engineering perspective. The work undertaken has ensured that the land required for the facility has been minimised so far as possible.

3.9.10 The relationship of the proposed layout of the facility and surrounding land uses and buildings and the storage and use of hazardous substances within the facility has been carefully considered and modelled (as described in **Chapter 22: Major Accidents and Hazards [TR030008/APP/6.2]**) in determining that a suitable layout can be provided within the proposed parameters.

Consideration of alternative locations for the jetty access road, pipe-rack and electrical control building

3.9.11 The jetty access road and pipe-rack are located together in a corridor through and adjacent to the Long Strip woodland, the boundary of which is defined by the extent of Work No. 2 as shown on the **Works Plans [TR030008/APP/4.2]**. The electrical control building is also located within Work No. 2 as well as a reserve corridor for pipelines in relation to future cargoes to connect to the public highway at Laporte Road.

3.9.12 The jetty access road provides vehicular and pedestrian access from Laporte Road to the jetty structure, including security facilities to enable adherence to the International Ship and Port Facility ("ISPS") Code[5]. The start and end points are fixed by the jetty structure and Laporte Road. The pipe-rack supports pipelines and utilities, linking the jetty structure with the refrigerated ammonia storage tank and therefore also has fixed start and end points. Furthermore, the length of the pipe-rack has been kept to a minimum and as straight as possible for efficiency and safety requirements. The electrical control building has an operations function and houses electrical equipment as well as welfare facilities and is needed close to the jetty access road alignment to service the utilities associated with the jetty. An initial location was identified near the sea wall although given the presence of a veteran tree, a more suitable location was identified within the area of overlap between Work Nos. 2 and 5.

3.9.13 Due to the presence of the Long Strip woodland between Laporte Road and the jetty structure, alternative designs were considered in order to minimise tree loss.

3.9.14 At the preliminary environmental information stage, it was reported that the pipe-rack and jetty access road would lead to the loss of a large part of the Long Strip woodland. Since this stage, the design has been informed by a detailed tree assessment, set out in **Appendix 8.F Arboricultural Impact Assessment [TR030008/APP/6.4].** The tree survey concludes that the highest value tree in

[5] The ISPS Code is a comprehensive set of measures designed to strengthen the security of ships and port facilities, as stated in Ship Security guidance provided by the Maritime and Coastguard Agency, first published in October 2012 and last updated in June 2021.

the Long Strip Woodland is located in the north east corner of the woodland close to the sea wall (a veteran ash tree), with high and moderate quality trees distributed throughout the remainder of the woodland.

3.9.15 Through the design development a number of alternative designs for the jetty access road have been reviewed. Road alignments placed outside of the Long Strip woodland both to the east and west have been considered. The options reviewed vary in terms of the alignment of the road in respect of the Long Strip woodland, implications for land ownership and environmental impact. It should be noted that all options reviewed would require some diversion or culverting of existing watercourses and therefore this was not a defining factor in the selection of the preferred design.

3.9.16 An option to place the road entirely to the west of the Long Strip woodland on a combination of APT leased land (forming part of the Immingham Oil Terminal) and Air Products' land would not be viable due to operational, security and safety reasons. The Immingham Oil Terminal is essential to the operations of the Humber Refinery and the Lindsey Oil Refinery. The Humber Refinery is a nationally significant piece of infrastructure, providing 11% of UK road fuel demand and 20% of all UK demand for petroleum products. Any material impairment to the operation of the Immingham Oil Terminal would therefore not be in the public interest. In this context, there is an existing firewater pond on APT land which would likely conflict with an access road in this location. The firewater pond would therefore need to be modified to accommodate both the construction and operation of the jetty access ramp, which would impact on operations at the Immingham Oil Terminal. The tenant also requires the land, where the road would need to be located for existing emergency access purposes.

3.9.17 A jetty access road to the west of Long Strip woodland would also require a longer jetty approach trestle which would have a greater impact on the intertidal zone than the preferred design that has been taken forward. Whilst this option would not result in tree loss within Long Strip woodland nor impact on Public Rights of Way, these reasons together were considered sufficient to discount this option.

3.9.18 An option to place the road to the east of Long Strip on third party (Tronox) land also has a number of constraints. Again, this would require a longer jetty approach trestle which would have a greater impact on the intertidal zone than the preferred design that has been taken forward. A jetty alignment in this location would also likely pass over two existing Anglian Water outfalls located in the intertidal zone which would need to be relocated. This relocation would lead to further impact on the intertidal zone during the construction process.

3.9.19 Other constraints with an option to the east include the presence of the veteran ash tree which may be impacted by the design and impacts on the Public Right of Way. Where the Public Right of Way would be impacted it would either need to be wholly relocated to the east of the access road, or, diverted at a high level across the jetty access road (and pipe racks). Both options could have potential safety and security issues relating to the need to restrict public access to the Project site when operational. The former option would also mean there would be no public access to, or enjoyment of the Long Strip Woodland.

3.9.20 A crossing through the woodland would still be required with this option to access the East Site. This would result in tree loss within the Long Strip woodland and the severance of the woodland with potential impacts on biodiversity caused by habitat fragmentation. The existing emergency pedestrian access from the APT site would also need to be diverted. Owing to the constraints of the other options reviewed, ABP then focussed on how options that ran through its own land could minimise tree loss in the Long Strip woodland. In light of this, two options were reviewed, one option that went straight through the Long Strip woodland wholly on ABP's land and an alternative option that utilised both ABP's land and land within East Site to reduce the loss of trees in the Long Strip woodland. The latter would initially pass through the western section of the Long Strip woodland on ABP's land before diverting to the west, outside of the Long Strip woodland onto the East Site. This option would not require the diversion of any part of the Public Right of Way and would continue to allow public access to the woodland; the other option that runs straight through the woodland would require a small diversion of the Public Right of Way on the approach to the junction with Laporte Road to avoid a clash with the alignment. Neither option would lead to severance of the Long Strip woodland. Both options would require the diversion of the existing APT emergency pedestrian access.

3.9.21 As there are more constraints associated with an alignment that runs straight through the Long Strip Woodland, the option that would result in the loss of fewer trees, avoiding the veteran ash tree and less impact on the Public Right of Way was taken forward and now forms part of this application for development consent.

3.10 The Sequential Test

3.10.1 Consideration of the sequential test is set out in the **Planning Statement [TR030008/APP/7.1]** which concludes that the appropriate area of search can only be the Humber in order to meet the Project objectives. The appropriate location for the Project within the Humber has been ascertained to be the Port of Immingham.

3.10.2 Only two sites of a suitable size have been identified that are at a lower risk from flooding than the Site - Immingham landfill site and land at the operational Port of Immingham. Although these sites are at a lower risk from flooding, they are in use and not available. The land within the Port is already developed and in active employment/port-related uses. The development of the Immingham landfill site for a hydrogen production plant would prevent the restoration of the waste site following cessation of its use contrary to the approved planning permission. Furthermore, it would not be possible to redevelop this site for a hydrogen production plant for several reasons:

a. The landfill generates ground gas and is therefore incompatible with piling, foundations and excavations;

b. The ground is not level, is uncompacted and unsuitable for civil foundations;

c. The landfill site is likely contaminated; and

d. Taking any material offsite defeats the original purpose of the landfill.

3.10.3 For these reasons, there are no other sites available or suitable for the Project that are a lower risk of flooding.

3.11 Summary and Conclusion

3.11.1 There is an imperative and urgent need for the Project to provide port infrastructure for the import and export of liquid bulk energy products in the Humber to support the transition to net zero and the decarbonisation of the Humber industrial cluster, and other locations.

3.11.2 The need for the Project is established by the NPSfP (Ref 3-1), which explains that it is for port operators and developers such as ABP to bring forward infrastructure in response to market demand, providing additional capacity, competition and resilience in the sector and delivering wider economic benefits in the public interest.

3.11.3 In particular, there is a national need for port infrastructure to support the energy sector in producing clean energy, specifically hydrogen production and CCS, in order to meet the aims of the Government's decarbonisation strategy and 2050 net zero obligations. The Humber industrial cluster emits more CO_2 than any other industrial cluster in the country and therefore decarbonising this region is essential to achieve net zero. The Project also helps to improve Britain's energy security and supports the Levelling Up agenda.

3.11.4 The Project is an appropriate solution to meet the need for new port infrastructure and landside facilities at the Humber. The Port of Immingham is considered to be the only appropriate site for the development of a Green Energy Terminal on the Humber, given its location and access to deep water. The layout of the Project has sought to minimise adverse effects and make effective use of appropriately designated available land.

3.12 References

Ref 3-1 Department for Transport (2012). The National Policy Statement for Ports.

Ref 3-2 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan.

Ref 3-3 Department for Business, Energy & Industrial Strategy (2020) Energy White Paper: Powering our net zero future

Ref 3-4 Department for Business, Energy & Industrial Strategy (2022) UK Hydrogen Strategy

Ref 3-5 Department of Energy & Climate Change (2011). Overarching National Policy Statement for Energy (EN-1)

Ref 3-6 Department for Business, Energy & Industrial Strategy (2022) British energy security strategy

Ref 3-7 Department for Levelling Up, Housing and Communities (2022) Levelling Up the United Kingdom

Ref 3-8 Department for Business, Energy & Industrial Strategy (2020) The ten point plan for a green industrial revolution

Ref 3-9 The Stationery Office Limited (2017). The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 3-10 The Stationery Office Limited (2008). Planning Act 2008.

Ref 3-11 Department for Energy Security and Net Zero (2023). Draft Overarching National Policy Statement for Energy (EN-1).

Ref 3-12 Department for Energy Security and Net Zero (2023). Powering Up Britain: Energy Security Plan.

Ref 3-13 Department for Energy Security and Net Zero and Department for Business, Energy and Industrial Strategy (2021). Net Zero Strategy: Build Back Greener.

Ref 3-14 The Stationery Office Limited (2015). The Control of Major Accident Hazard (COMAH) Regulations 2015.

Ref 3-15 The European Union (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

Immingham Green Energy Terminal

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Volume 6

6.2 Environmental Statement

Chapter 5: EIA Process

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

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6.2 Environmental Statement

Chapter 5: EIA Process

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Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR0300008/APP/6.2
Author	Associated British Ports Air Products BR

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Revision 1	21 September 2023	DCO Application

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5 EIA Approach

5.1 Introduction

5.1.1 This chapter presents the approach undertaken in the Environmental Impact Assessment ("EIA") to identify and evaluate the likely significant effects of the Project on the environment and to identify the measures to mitigate or manage any significant adverse effects. The EIA approach has been informed by scoping and consultation with statutory consultees, other interested bodies and members of the public as detailed below.

5.2 EIA Approach and Scope

5.2.1 This Environmental Statement ("ES") has been prepared to satisfy the requirements of Regulation 14 of *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017* ("the EIA Regulations") (as amended) (Ref 5-8).

5.2.2 In undertaking the EIA and preparing the ES (in line with the EIA Regulations) reference has been made to the following policy and guidance in respect of the approach taken for the assessment:

a. National Policy Statement for Ports (Ref 5-14).

b. Planning Act 2008: *Guidance on the Pre-Application Process for Major Infrastructure Projects* (Ref 5-12).

c. Planning Inspectorate Advice Note Three: *EIA Consultation and Notification* (Ref 5-1).

d. Planning Inspectorate Advice Note Seven: *Environmental Impact Assessment, Preliminary Environmental Information, Screening and Scoping* (Ref 5-2).

e. Planning Inspectorate Advice Note Nine: *Rochdale Envelope* (Ref 5-3).

f. Planning Inspectorate Advice Note Ten: *Habitats Regulations Assessment* (Ref 5-4).

g. Planning Inspectorate Advice Note Twelve: *Transboundary Impacts and Process* (Ref 5-5).

h. Planning Inspectorate Advice Note Seventeen: *Cumulative Effects Assessment Relevant to National Significant Infrastructure Projects* (Ref 5-6).

i. Planning Inspectorate Advice Note Eighteen: *The Water Framework Directive* (Ref 5-7).

j. Institute of Environmental Management and Assessment's ("IEMA") *Delivering Proportionate EIA* (Ref 5-9) guidance document.

5.2.3 A summary of the key legislation, policy and guidance against which the Project has been assessed, and which have been considered as part of the EIA of the Project, are set out in **Chapter 4: Legislative and Consenting Framework [TR030008/APP/6.2]**.

Overarching Approach

5.2.4 EIA is a process for identifying the likely significant environmental effects (positive and negative) of a proposed project to inform the decision-making process for development consent to be granted.

5.2.5 EIA aims to be a systematic, analytical, impartial, consultative and iterative process of identifying, evaluating and mitigating the likely significant environmental effects of a project. It promotes the early identification and evaluation of the likely significant effects and enables appropriate mitigation (that is measured to avoid, reduce or offset significant adverse effects) to be identified and incorporated into the design of the development, or commitments to be made to environmentally sensitive construction methods and practices.

5.2.6 The Project design has been refined throughout the EIA process as a result of consultee feedback and progression of the environmental assessments and design development. The EIA recognises that the Project's design will be subject to detailed design and further refinement and optimisation post grant of the development consent order and therefore to ensure the worst-case scenario for the likely significant effects of the Project is assessed in line with the Rochdale Envelope principle, minimum and maximum parameters have been assessed (as appropriate). The Rochdale Envelope principle is explained further in **Section 5.7**.

5.2.7 Preparation of this ES has been informed by the *Planning Inspectorate's Advice Note Seven* (Ref 5-2) and reflects that the EIA Regulations require an ES to focus on aspects of the environment likely to be subject to significant effects. Accordingly, this ES, where appropriate and in accordance with the Scoping Opinion, scopes out aspects/matters from further assessment where likely significant effects are not anticipated with suitable justification being provided. This streamlines the assessment process to focus on likely significant effects and ensures it remains proportionate, in accordance with the Institute of Environmental Management and Assessment's ("IEMA") *Delivering Proportionate EIA* (Ref 5-9) guidance document.

5.3 Issues for Consideration in the EIA

5.3.1 A scoping exercise was undertaken to determine the extent of issues to be considered in the EIA and reported in the ES. The scoping exercise reported in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) identified the following environmental topics which should be considered in the EIA on the basis that construction, operation and demolition works of the Project could potentially lead to significant effects on the environment. This ES subsequently reports on each of the following environmental topics:

a. Air Quality.

b. Noise and Vibration.

c. Nature Conservation (Terrestrial Ecology).

d. Nature Conservation (Marine Ecology).

e. Ornithology.

f. Traffic and Transport.
g. Marine Transport and Navigation.
h. Landscape and Visual Impact.
i. Historic Environment (Terrestrial).
j. Historic Environment (Marine).
k. Physical Processes.
l. Marine Water and Sediment Quality.
m. Water Quality, Coastal Protection, Flood Risk & Drainage.
n. Climate Change.
o. Materials and Waste.
p. Ground Conditions and Land Quality.
q. Major Accidents and Disasters.
r. Socio-economics.
s. Human Health and Well-being.
t. Cumulative and In-Combination Effects.

5.3.2 The scoping exercise examined whether decommissioning of the Project could result in significant effects within the above environmental topic areas. This concluded that it would be unlikely that the terminal, including the jetty access road, would be decommissioned as these facilities would, once constructed, become part of the Port infrastructure so that they could be used for port-related activities to meet a long-term need. Therefore, decommissioning of the terminal, including the jetty access road, has not been considered further within the ES. However, the hydrogen production facility has a design life of up to approximately 25 years and, although the operational life could be longer, this infrastructure would be decommissioned when appropriate. Decommissioning of the hydrogen production facility is therefore considered within the ES.

5.3.3 The scoping exercise identified the need to undertake a range of other assessments to inform the EIA, and which form part of the DCO application. The following assessments have been undertaken, and coordinated with the ES chapters, to minimise duplication of information between assessments:

a. **Appendix 2.A: Waste Hierarchy Assessment [TR030008/APP/6.4]** – this assessment has referenced the information gathered as part of the assessment reported in **Chapter 16: Physical Processes** and **Chapter 17: Marine Water and Sediment Quality [TR/030008/APP/6.2]**.

b. **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]** – the assessment has referenced the information gathered as part of the assessment reported in **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**.

c. **Appendix 17.A: Water Framework Directive Compliance Assessment [TR030008/APP/6.4]** – this assessment has referenced the information gathered as part of the assessment reported in **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

d. **Appendix 18.A: Flood Risk Assessment [TR030008/APP/6.4]** – this assessment has referenced the information gathered as part of the assessment reported in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

e. **Shadow Habitats Regulations Assessment** ("HRA") **[TR030008/APP/7.6]** – this assessment has referenced the information gathered as part of the ornithology assessment reported in **Chapter 10: Ornithology [TR/030008/APP/6.2]**.

f. **Without Prejudice Shadow Habitats Regulations Assessment (HRA) Derogation Report [TR030008/APP/7.3]** – this report is provided on a without prejudice basis and presents the case for derogation from the Habitats Directive, should Natural England consider that there is an adverse effect on integrity of the European Marine Site.

g. **Marine Plan Conformance Assessment**– this assessment, which forms Appendix B of the **Planning Statement [TR030008/APP/7.1]**, has referenced information presented in this ES.

5.4 Scoping Opinion

5.4.1 The Applicant made a request to the Planning Inspectorate, (acting on behalf of the Secretary of State) on 30 August 2022, to obtain its written opinion on the scope and level of detail of the information to be provided in the ES, under Regulation 10(1) of the EIA Regulations (Ref 5-8).

5.4.2 The request was accompanied by the **EIA Scoping Report** (provided in **Appendix 1.A [TR030008/APP/6.4]**, which provided the information required by Regulation 10(3) of the EIA Regulations (Ref 5-8).

5.4.3 The Planning Inspectorate provided its **Scoping Opinion** on 10 October 2022 (**Appendix 1.B [TR030008/APP/6.4]**), which took account of the content of the EIA Scoping Report and the responses received from the consultation bodies engaged.

5.4.4 The Scoping Opinion confirmed agreement with the majority of the proposed EIA scope but highlighted a number of additional matters requiring consideration, which are detailed in the section below. **Appendix 1.C [TR030008/APP/6.4]** provides a summary of how issues raised in the Scoping Opinion by the Inspectorate and by consultees have been addressed in the ES.

5.5 Modifications to the EIA Scope

Scoping Opinion Outcomes

5.5.1 Matters raised within the **Scoping Opinion** (**Appendix 1.B [TR30008/APP/6.4]**) were reviewed against the content of the EIA Scoping Report (provided in **Appendix 1.A [TR030008/APP/6.4]**) to identify where changes to the approach and/or further survey and assessment were necessary.

5.5.2 The scope of the EIA was accordingly modified by the Applicant to take account of the requirements of the scoping opinion, fulfilling its obligation under Regulation 14(3) of the EIA Regulations (Ref 5-8) in relation to the ES having to be based on the most recent scoping opinion adopted.

5.5.3 Full details of how the EIA scope was modified in response to the Scoping Opinion are presented in **Appendix 1.C [TR030008/APP/6.4]**. The following sub-sections detail the other stages which have influenced the EIA scope.

Engagement Outcomes

5.5.4 Following receipt of the **Scoping Opinion** (**Appendix 1.B [TR030008/APP/6.4]**) engagement continued with statutory and non-statutory bodies through a combination of two rounds of statutory consultation, written correspondence and meetings, the purpose of which was to obtain further views and opinions on the Project and EIA aspects. This included the scope of work being undertaken, the methodologies being followed, the prediction and assessment of impacts and effects, the development of mitigation measures, and requirements for monitoring significant environmental effects.

5.5.5 The outcomes of engagement, including how feedback has been addressed, are summarised in **Chapters 6** to **24 [TR030008/APP/6.2]** and considered in detail in the **Consultation Report [TR030008/APP/5.1]**. Statutory consultation outcomes did not identify the need to introduce any new topics to those previously identified in the Scoping Report.

5.5.6 Full details of the engagement undertaken during the EIA process, the responses received and how those responses have been taken into account are presented within the **Consultation Report [TR030008/APP/5.1]**.

Publication of New Guidance

5.5.7 Subsequent to receipt of the **Scoping Opinion** (**Appendix 1.B [TR030008/APP/5.4]**) new assessment guidance relating to certain topics under consideration in the EIA was published. The Applicant has accordingly reviewed any new changes introduced by this new guidance against the approach presented in the Scoping Report and has given this due regard when undertaking the EIA. Where this is applicable, and to avoid duplication, this is described within the relevant technical chapters of the ES.

Design-development Outcomes

5.5.8 Continued development of the Project design during the EIA has resulted in a number of changes which have influenced the scope of the individual assessments progressed following publication of the **Scoping Opinion** (**Appendix 1.B [TR030008/APP6.4]**). Additional data collection, modelling and assessment have been undertaken and reported in the ES to address the changes, however none of the changes to the Project affect the conclusions reached on the scope of the ES as set out within the Scoping Opinion.

5.5.9 Refinements have been made to the engineering and environmental design of the Project in response to:

a. The outcome of statutory consultation.

b. The outcome of non-statutory consultation with external stakeholders and bodies, outside of the statutory consultation process. This includes the views expressed by statutory and non-statutory bodies, landowners and utility companies.

c. The EIA process, whereby the result of environmental baseline surveys and assessments of likely significant effects have iteratively informed the Project design.

5.5.10 **Chapter 3: Need and Alternatives [TR030008/APP/6.2]** describes how the design of the Project has developed since undertaking the scoping exercise, and how the considerations have influenced its final form. The **Planning Statement [TR030008/APP/7.1]** submitted with the Development Consent Order ("DCO") application also provides details of the Project design evolution.

5.5.11 The Scoping Opinion, and the advice contained within it regarding assessment methodology, topics and presentation of the ES, together with responses received through consultation and engagement, the design development outcomes, and any new guidance, have been taken into account in the preparation of this ES.

5.6 Environmental Statement

5.6.1 This ES presents a description of the Project and its likely significant environmental effects during construction, operation (including maintenance where relevant) and decommissioning (of the hydrogen production facility). It also details measures to avoid or reduce or offset such effects and the alternatives considered.

5.6.2 For the purposes of the EIA, the full capacity of the jetty, of up to 292 vessel calls per year, has been assessed in this ES. Similarly, the landside infrastructure required to transport ammonia from the jetty, store and convert it into green hydrogen is also assessed for the phased build out of the operational development (all six phases) and decommissioning. **Chapter 2: The Project [TR030008/APP/6.2]** provides a full description of the Project.

5.6.3 This ES summarises the outcome of the following EIA activities:

a. Establishing baseline conditions.

b. Consultation with statutory and non-statutory consultees.

c. Consideration of relevant local, regional and national planning policies, guidelines and legislation relevant to the EIA.

d. Consideration of technical standards for the development of significance criteria and specialist assessment methodologies.

e. Design review.

f. Review of previous environmental studies, publicly available information, desktop studies and online databases.

g. Expert opinion.

h. Physical surveys and monitoring.

i. Desk-top studies.

j. Modelling and calculations.

5.6.4 These activities have enabled the prediction of impacts in relation to the current and future baseline, and a prediction based on the information available of the likely significance of effects due to the Project on environmental receptors.

5.6.5 The term ‘impact’ refers to changes arising from the Project on a resource or receptor, whereas the term ‘effect’ is used to describe the consequence of the impact on a resource or receptor.

5.6.6 Resources comprise environmental aspects which support and are essential to natural or human systems. These include areas or elements of population, ecosystems, watercourses, air and climatic factors, landscape, and material assets.

5.6.7 Receptors comprise people, for example occupiers of dwellings, users of recreational areas and community facilities, and elements within the environment, for example flora and fauna, that rely on environmental resources.

5.6.8 Each technical chapter within this ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) follows the same structure for ease of reference:

a. Introduction.

b. Consultation and Engagement (including scoping and statutory consultation responses).

c. Legislation, policy and guidance.

d. Assessment method.

e. Study area.

f. Baseline conditions.

g. Development design and impact avoidance.

h. Potential impacts and effects.

i. Mitigation measures.

j. Assessment of Residual effects.

k. Summary of assessment.

l. References.

m. Abbreviations and glossary of terms.

Statement of Competence

5.6.9 To ensure the completeness and quality of the ES, Regulation 14(4)(a) of the EIA Regulations requires the ES to be undertaken by competent experts.

5.6.10 A statement of competence of the EIA coordinators and the technical specialists that have provided expert input to the ES is included as **Appendix 1.D [TR030008/APP/6.4]** to satisfy Regulation 14(4)(b) of the EIA Regulations.

5.7 Rochdale Envelope Parameters and Managing Design Uncertainty

5.7.1 The design of large infrastructure projects such as the Project necessarily evolves to respond to design challenges, stakeholder views and the findings of the EIA process.

5.7.2 Following submission of the DCO Application, the design of the Project is expected to continue to develop in the lead-in to the DCO Application examination, and will be further refined up until the start of construction (subject to authorisation by the Secretary of State). In order to account for these possible future changes (and particularly for post consent changes) in the EIA process, it has been necessary to make a number of assumptions about what is termed a 'reasonable worst-case'.

5.7.3 Design uncertainty is addressed within the EIA by adopting a precautionary approach to identifying significant environmental effects, through the establishment of a series of maximum and minimum development parameters which constitute that has become known as a 'Rochdale Envelope'.

5.7.4 The Rochdale Envelope arises from United Kingdom ("UK") case law (Ref 5-10). It is an established principle that allows a number of parameters to be set to establish an envelope within which the Project would be delivered. Its adoption allows robust EIA to be undertaken by defining a reasonable worst-case scenario that decision-makers can consider when determining the acceptability or otherwise of the environmental effects of the Project.

5.7.5 The principle is founded on the assumption that, as long as the technical and engineering design of a project falls within the limits of the envelope defined by these parameters (including geographical and technical limits), and the EIA has considered the likely significant effects of a project coming forward within that envelope (based on the reasonable worst-case scenario), then flexibility within those parameters is deemed to be permissible within the terms of any consent granted for the Project.

5.7.6 The reasonable worst-case scenario assumes that one or other of the parameters would have a more significant adverse effect than the alternative, and where a range of parameters is provided, the most environmentally detrimental parameter is assessed in the EIA. The worst-case scenario can differ between the environmental topics being assessed, and the environmental resources or receptors potentially affected.

5.7.7 Advice published by the Planning Inspectorate (Ref 5-3) fully endorses the approach of assessing design uncertainty, whilst still meeting the requirements of the EIA Regulations.

5.7.8 In line with this approach, parameters have been established across aspects relating to the design and construction of the Project to manage design uncertainty and provide flexibility for deviation where needed. For example, flexibility may be needed to enable minor design refinements to be made during construction by the appointed contractor within the overall parameters of any consent granted and which would not produce different significant effects to those as reported within this ES.

5.7.9 This approach to managing uncertainty within defined parameters and limits (as set out in **Chapter 2: The Project [TR030008/APP/6.2]**) ensures that the likely significant environmental effects of the final design or any design changes that may arise post submission of the DCO Application have been assessed by the EIA.

5.8 Defining Study Areas: Spatial Scope of Assessment

5.8.1 The study area (or 'the spatial scope') for each environmental aspect, the area over which changes to the environment are predicted to occur as a consequence of the Project, depends on the nature of the potential impacts and the location of receptors that could be affected. Study areas take account of:

a. The physical area and characteristics of the Project.

b. The nature of the existing and future baseline environment.

c. The manner and extent to which environmental impact may occur.

5.8.2 Each individual technical assessment of this ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) defines the study area considered and provides a rationale to support its selection, including consideration of the current baseline conditions such as the presence of any sensitive features and/or designations within, or adjacent to, the proposed study area.

5.8.3 The Site Boundary, as illustrated on **Figure 1.1 [TR030008/APP/6.3]**, has been assessed within this ES.

5.9 Temporal Scope

5.9.1 The temporal scope covers the time period over which changes to the environment and the resultant effects are predicted to occur, and are typically defined as either being permanent or temporary:

a. Permanent – these are effects that would remain even when the Project is complete, although these effects may be caused by environmental changes that are permanent or temporary.

b. Temporary – these are effects that are related to environmental changes associated with a particular activity and that would cease when that activity finishes.

5.9.2 The assessment evaluates the environmental effects of the phased approach to construction and operation as summarised in **Table 2-1** of **Chapter 2: The Project [TR030008/APP/6.2]**.

5.9.3 As stated in **Section 2.1** of **Chapter 2: The Project [TR030008/APP/6.2]**, consideration of effects from decommissioning of the Project are considered within the EIA where necessary (i.e. in relation to the hydrogen production facility).

5.10 Characterisation of the Existing and Future Baseline Environment

5.10.1 To assess the potential environmental effects resulting from the Project, it is necessary to first establish the environmental conditions that currently exist within the Site Boundary and the surrounding vicinity, where relevant.

5.10.2 Appropriate understanding of the baseline for each technical environmental discipline has been collated through some or all of the following:

a. Review of secondary sources (desk-based i.e. review of existing documentation and literature; data searches and available datasets).

b. Review of primary baseline studies (field surveys).

c. Stakeholder consultation.

5.10.3 Existing baseline conditions have been defined for each technical assessment topic in **Chapters 6** to **24 [TR/030008/APP/6.2]** based on the data sources detailed in the paragraph above (as applicable). It is also important to consider future baseline conditions (in the absence of the Project) against which the effects of the Project can be assessed.

5.10.4 The key data sources used to establish baseline conditions are described in each technical assessment chapter (**Chapters 6** to **24 [TR030008/APP/6.2]**).

Baseline Conditions (including Future Baseline)

5.10.5 The 'existing baseline' date is 2022/2023 since this is the period in which the baseline studies have been undertaken as part of the EIA process. The baseline used within the Preliminary Environmental InformationReport was 2022. Further survey work for the Project to further define baseline conditions has been undertaken in early 2023. Exceptions to this are outlined within the individual baseline sections of the technical ES chapters.

5.10.6 'Future baseline' conditions are also predicted for each assessment scenario; these represent the likely conditions anticipated to prevail at a certain point in the future in the absence of the Project.

5.10.7 The assessment scenarios that have been considered for the purposes of the EIA (and addressed in this ES) are:

a. Existing baseline (2022/2023).

b. Future baseline (No Development) (up to Quarter (Q) 1 2025 (anticipated start of construction), 2026 for Traffic and Transport, Air Quality and Noise and Vibration, and 2042 for landscape and visual effects only, and 2060 (in relation to the assessment of decommissioning impacts) against which the environmental effects of the Project are assessed. These assessment years are explained below. The future baseline is defined within each technical chapter (**Chapters 6 to 24 [TR030008/APP/6.2]**).

c. Construction: subject to the necessary consents being granted, construction of the Project is anticipated to start in Q1 2025 with the construction of the terminal and first phase of the green hydrogen production facility (including works on both the East and West Site). Following completion of the first phase of the hydrogen production facility, a further five phases would be constructed incrementally to increase the processing capacity as the market for green hydrogen increases. For the purposes of this ES, a development scenario has been defined for the Project. This scenario is based on a six-phase construction timeline commencing in Q1 of 2025, through to full completion of all phases in 2036 (see **Chapter 2: The Project [TR030008/APP/6.2]**).

d. Opening and/or operation: assuming an approximate 11-year construction programme for the full development (all six phases), followed by a period of commissioning for each construction phase, commercial operation of phase 1 is likely to commence between Q1 and Q4 2027, following a two and a half to three-year construction period. The assessment years within each technical assessment have been chosen as the reasonable worst-case for each topic to ensure effects are considered when they are at the greatest magnitude of impact

e. Decommissioning: it is envisaged that the landside elements (the hydrogen production facilities) of the Project would have an operational life of approximately 25 years. On this basis, decommissioning activities of these landside elements are currently anticipated to commence after 2060. However, the operational life of the landside elements of the Project could be longer, depending on its integrity and market conditions at that time. The marine infrastructure would not be decommissioned.

5.10.8 A future year of 2042 (i.e. 15 years post-opening of the Project) is also considered by specific topics, including landscape and visual amenity to take account of the maturation of mitigation landscape planting.

5.11 Environmental Mitigation

Design Development, Impact Avoidance and Mitigation

5.11.1 The Project design development process has been heavily influenced by the findings and feedback obtained throughout the EIA and consultation process. The Project has had a number of measures incorporated into the concept design to avoid or minimise environmental impacts. The key aspects of the Project design which have evolved through design development, and in response to statutory consultation, are described in the **Planning Statement [TR030008/APP/7.4]** and in **Chapter 2: The Project** and **Chapter 3: Need and Alternatives [TR030008/APP/6.2]**. These include legal compliance measures, as well as measures that implement the requirements of best practice guidance documents (e.g., Environment Agency guidelines on pollution prevention). The assessments have been undertaken on the basis of these measures being implemented (e.g., they are 'embedded mitigation').

Environmental Measures

5.11.2 Consistent with Regulation 14(2)(c) of the EIA Regulations (Ref 5-8), the ES includes a description of the *"…measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment".*

5.11.3 For each environmental topic the EIA process has systematically identified impacts and effects; and has taken into consideration environmental measures that the Project would adopt. These measures, which are reported throughout the technical chapters of this ES, include avoidance, best practice and design commitments as follows:

a. *Embedded mitigation measures:* modifications to the location, design or operation of a development that are an inherent part of the Project and do not require additional action to be taken.

b. *Standard mitigation measures:* measures comprising management activities and techniques, which would be implemented during construction of the Project to limit impacts through adherence to good site practice and achieving legal compliance. These measures for the construction phase are set out in the **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.4]**.

c. *Additional mitigation measures:* these comprise measures over and above any embedded and standard mitigation measures, for which the EIA has identified a requirement to further reduce likely significant environmental effects.

5.11.4 Implementation of embedded, standard and additional mitigation measures relied on in the assessment are outlined in the **Schedule of Mitigation and Monitoring [TR030008/APP/7.2]** and where relevant, these are proposed to be secured through the schedules and requirements contained within the **draft DCO [TR030008/APP/2.1]**.

5.11.5 The assessment presented in the technical chapters of this ES firstly takes into account the effectiveness of both embedded mitigation and standard mitigation measures, as these comprise measures that would be delivered as an integral component of the design of the Project and through the application of best practice construction techniques during its construction. Embedded and standard mitigation measures are identified within the 'Design Development and Impact Avoidance' sections of each technical chapter of this ES.

5.11.6 Once the likely significant effects have been identified and quantified, consideration has been given to any 'additional mitigation' over and above the embedded and standard mitigation. Where significant effects remain following the implementation of embedded and standard mitigation, and additional mitigation could lower the identified effect, each technical chapter of this ES has identified this and explains how the additional mitigation will be secured, for example, via a specific DCO requirement or a via a management plan or a document secured by a DCO requirement.

5.11.7 When environmental measures form an integral part of the Project design (i.e. embedded mitigation and standard mitigation) and/or the approach to its construction, the assessment of likely significant effects only reports the post-mitigation effects within this ES. Due to topic specific guidance, some assessments deviate from this standard approach. When this is the case it is outlined in individual topic assessments as appropriate.

5.11.8 Where additional mitigation measures are identified, the ES reports both pre- and post-mitigation effects in order to demonstrate their efficacy in further reducing the significance of effects and explains how such measures will be secured.

5.11.9 Following the identification of additional mitigation measures, the assessment of effect significance is re-evaluated to determine whether there is likely to be a residual effect and if it remains significant. Residual effects assessed as Moderate or Major after consideration of mitigation measures have been subject to additional analysis of the potential to further mitigate them, where feasible. Where additional mitigation is not possible a significant residual effect may remain.

5.11.10 Where significant residual effects are predicted, proportionate monitoring measures have been identified in accordance with the requirements of Schedule 4 of the EIA Regulations (Ref 5-8). Details of the monitoring procedures to be implemented during and post-construction of the Project are presented in the **Outline CEMP [TR030008/APP/6.5]** and the **Schedule of Mitigation and Monitoring [TR030008/APP/7.2]**, which are included in the DCO Application.

5.12 Environmental Effects

5.12.1 Within this ES, environmental effects are defined as arising as a result of impacts (changes brought about by the Project) which act upon receptors (or resources). As an example, a change in air quality generated by the development would be an impact and the response at the receptor, such as a habitat, which may decline in value as a result of the change in air quality, would be the environmental effect. For an effect to occur there has to be a pathway between the impact and the resource or receptor.

5.12.2 In the EIA, effects are formulated as a function of the importance, value or sensitivity of an environmental resource or receptor, and the magnitude of impact (or change) predicted. A combination of professional judgement, defined thresholds, established criteria and standards are used in the definition of effects within this ES.

5.12.3 The significance criteria presented in **Section 5.13** of this chapter have been used to report the significance of effects, the assignment of which relies on reasoned argument, professional judgement, established thresholds and guidelines, and the views of relevant organisations.

5.12.4 Account is taken of the role of mitigation measures, as discussed in **Section 5.11**, in reducing the significance of adverse effects.

5.13 Significance Criteria

5.13.1 For consistency, the methodology described in this section has been applied across the assessed environmental topics included within this ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) to ensure the predicted environmental effects are assessed and evaluated in a comparable manner.

5.13.2 Variations from this approach are applicable to specific environmental topics where other prevailing standards, thresholds and/or established criteria exist that require application. Where this is the case, an outline is provided in the applicable technical assessment chapters of the ES **[TR030008/APP/6.2]**:

a. **Chapter 12: Marine Transport and Navigation**
b. **Chapter 13: Landscape and Visual Impact**
c. **Chapter 19: Climate Change**
d. **Chapter 20: Materials and Waste**
e. **Chapter 22: Major Accidents and Disasters**
f. **Chapter 24: Human Health and Well-being**

5.13.3 **Table 5-1** presents the generic guidelines for the sensitivity (or importance/value) of a resource or receptor that have been applied within this ES.

Table 5-1: Generic Guidelines for the Assessment of Receptor Sensitivity

Sensitivity (or importance/value)	Typical Descriptors
High	The resource or receptor has a very low capacity to accommodate the proposed form of change without fundamentally altering its present character; possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site or receptor; is of international or national importance.
Medium	The resource or receptor has a low capacity to accommodate the proposed form of change without significantly altering its present character; possesses key characteristics which contribute significantly to the distinctiveness and character of the site or receptor; is of regional or county importance.
Low	The resource or receptor has some tolerance to accommodate the proposed change without detriment to its character; possesses characteristics which are locally significant; is either not designated or is designated at a local or district level.
Very Low	The resource or receptor is generally tolerant and can accommodate the proposed change without detriment to its character; resource or receptor characteristics; does not make a significant contribution to local distinctiveness; and is not designated.

5.13.4 **Table 5-2** presents the generic magnitude of impact (or change) criteria that have been applied within this ES.

Table 5-2: Generic Guidelines for Determining the Magnitude of Impact (or change)

Magnitude of Impact (or change)	Typical Descriptors
High	The total loss or major change/substantial alteration to key elements/features of the current (pre-development) baseline conditions, such that the character/ composition/attributes of the baseline would be fundamentally changed post-development.
Medium	Loss or alteration to one or more key elements/features of the current (pre-development) baseline conditions, such that the character/ composition/attributes of the baseline will be materially changed post-development.
Low	Noticeable or small-scale change in character/composition/attributes of the current (pre-development) baseline conditions. Change arising would be discernible/detectable but not material post-development.

Magnitude of Impact (or change)	Typical Descriptors
Very Low	Very small-scale change or barely discernible changes in character/composition/attributes of the current (pre-development) baseline conditions post-development.

5.13.5 Once the magnitude of impact (or change) and the sensitivity of the receptor has been established, the significance of an effect can be assessed. Development proposals affect different environmental elements to varying degrees and not all of these are of sufficient concern to warrant detailed investigation or assessment within the EIA process. The EIA Regulations (Ref 5-8) identify those environmental resources that warrant investigation as those that are *"likely to be significantly affected by development"* (Schedule 4(4)).

5.13.6 The identification of effect significance typically requires the application of professional judgement; however, the overarching significance matrix used in the EIA is shown in **Table 5-3**. The generic definitions that have been used to determine the level of effect significance are shown in **Table 5-4**. Reference is made to:

a. 'Major' and 'moderate' effects, which would always be determined as being significant.

b. 'Minor' or 'negligible' effects, which would always be deemed as 'not significant'.

c. Effects can be beneficial or adverse.

Table 5-3: Generic Significance Evaluation Matrix

		Magnitude of Change			
		Very Low	Low	Medium	High
Sensitivity of Receptor	High	Minor	Moderate	Major	Major
	Medium	Minor	Minor	Moderate	Major
	Low	Negligible	Minor	Minor	Moderate
	Very Low	Negligible	Negligible	Minor	Minor

Table 5-4: Generic Significance of Effect Description

Significance Category	Indicative Description
Major	Very large or a large change in environmental conditions. Effects, both negative and positive, which are likely to be important considerations at a national to regional level because they contribute to achieving national or regional objectives, or which are likely to result in exceedance of statutory objectives or breaches of legislation. These effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	Intermediate change in environmental conditions. Effects are likely to be important considerations at a regional or at a local level and important in informing the decision-making process.
Minor	Small change in environmental conditions that are unlikely to be material in the decision-making process.
Negligible	No discernible change in environmental conditions. An effect that is likely to have a neutral or negligible influence.

5.13.7 In subsequent chapters of this ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) the general criteria described above have been made more topic-specific for each environmental topic based on relevant standards and guidelines. Further explanation of the approach to assessing impacts and effects, and the specific criteria used for each topic is set out in each chapter, with any deviation from this standard approach noted.

5.14 Cumulative and In Combination Effects

5.14.1 As required by the EIA Regulations, consideration has been given to the potential for cumulative and combined effects to arise as a result of the Project.

5.14.2 Cumulative effects are those that accrue over time and space from a number of development activities. The impact of the Project has been considered in conjunction with the potential impacts from other projects or activities which are reasonably foreseeable in terms of delivery. This includes projects for which applications for development consent and/or planning permission have been submitted, but have not yet been approved and projects that have planning permission or development consent that are located within a geographical scope (and where sufficient environmental information is available) where environmental impacts could act together with the Project to create a more significant overall effect on a receptor.

5.14.3 In-combination (or combined) effects are those resulting from a single development, in this case the Project, on any one receptor that may collectively cause a greater effect (such as the combined effects of noise and air quality/dust impact during construction on local residents).

5.14.4 The approach to the assessment of cumulative and in-combination effects takes into account guidance contained within Planning Inspectorate *Advice Note Seventeen*: *Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects* (Ref 5-6), which provides advice on the identification and assessment of other planned developments. **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** presents the findings of the assessment.

5.15 Transboundary Effects

5.15.1 Regulation 32 of the EIA Regulations and the Planning Inspectorate *Advice Note Twelve: Transboundary Impacts and Process* (Ref 5-5) and specifically Annexes A and B, set out the criteria and relevant considerations to be taken into account by the Planning Inspectorate when screening Nationally Significant Infrastructure Project ("NSIPs") for likely significant effects on the environment on European Economic Area ("EEA") states.

5.15.2 The Planning Inspectorate, on behalf of the Secretary of State, issued a first transboundary screening assessment on 2 March 2023 (Ref 5-13) following the Applicant's request for a scoping opinion. The Inspectorate's assessment concluded that the Project is likely to have a significant effect on the environment in an EEA state. This was found to be applicable to Denmark and Iceland, given that the features of the Humber Estuary Special Protection Area ("SPA") include the following species associated with populations in Denmark and Iceland:

a. Red knot comprising 6.3% of the Northeastern/ Canada/Greenland/Iceland/North western Europe populations.

b. Black-tailed godwit comprising 2.6 - 3.2% of the Icelandic breeding population.

5.15.3 The Inspectorate also stated that qualifying features of the Humber Estuary Ramsar site include the following species associated with populations in Denmark and Iceland:

a. Golden plover representing 2.2% of the Iceland and Faroes/East Atlantic population.

b. Black-tailed godwit comprising 3.2% of the Iceland/West Europe populations.

5.15.4 Therefore the states of Denmark and Iceland have been notified of the Project by the Inspectorate.

5.15.5 However, based on the evidence and assessment provided within this ES (see **Chapter 10: Ornithology [TR030008/APP/6.2]** and the **HRA [TR030008/APP/7.6]**), effects on EEA states, including Denmark and Iceland, are not predicted to occur as a result of effects from the Project on the relevant qualifying features of the SPA and Ramsar, as the Project's effects are predicted to be localised and not significant.

5.16 Consultation and Engagement

5.16.1 The Project has a wide range of stakeholders with differing interests that have been consulted. Specific communication activities have been undertaken to meet the needs of specific individuals and groups, based on an understanding of the stakeholders and their interests in the Project.

Pre-application Consultation

5.16.2 Pre-application consultation has been undertaken to seek the views of statutory consultees, the local community and other interested groups and individuals and individuals on the Project proposals which have been developed. Two rounds of statutory consultation have been undertaken in accordance with the requirements of the *Planning Act 2008* ("2008 Act") (Ref 5-11), the EIA Regulations (Ref 5-8) and the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 ("APFP Regulations") (Ref 5-20).

5.16.3 The Applicant has undertaken pre-application consultation with a range of prescribed consultees. Key stakeholders that have been consulted as part of the pre-application process include:

a. Prescribed statutory bodies.

b. Local authorities.

c. Landowners/those with interests in the land.

d. Local communities.

e. Other key interest groups.

5.16.4 Consultation and engagement with stakeholders has helped to inform the preparation of key materials as part of the EIA.

5.16.5 A Consultation Report **[TR030008/APP/5.1]** forms part of the DCO Application and summarises how pre-application consultation was undertaken and how feedback received, including the feedback on the statutory consultation, was taken into account by the Applicant. Each of the technical chapters of the ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) summarise the consultation comments relevant to the topic chapter and the corresponding response.

Technical Engagement

5.16.6 In addition to the stages of pre-application consultation, the Applicant has held informal engagement with the key prescribed consultees, as appropriate, to refine the Project design and the EIA and to assist in the development of any required mitigation or other environmental measures. Specific information on this is presented in the environmental topic chapters (**Chapters 6** to **24 [TR030008/APP/6.2]**).

5.16.7 A summary of technical stakeholder engagement is provided within the individual technical chapters within this ES. In addition, the Applicant will seek to agree Statements of Common Ground ("SOCG") with key stakeholders to set out matters that have been agreed prior to the examination of the DCO Application.

5.17 Assumptions and Limitations

5.17.1 In addition to the use of the Rochdale Envelope principles to manage design uncertainty, a number of general limitations have been encountered when undertaking the EIA, noting that these do not necessarily apply universally to each technical ES chapter. These have influenced how data collection, modelling and assessment have been progressed and reported in the ES. Each technical chapter of the ES (**Chapters 6** to **24 [TR030008/APP/6.2]**) sets out any assumptions made, and limitations encountered whilst undertaking and reporting their respective assessments.

5.18 References

Ref 5-1 The Planning Inspectorate (2017). Advice Note Three: EIA Consultation and Notification (Version 7).

Ref 5-2 The Planning Inspectorate (2020). Advice Note Seven: Environmental Impact Assessment, Preliminary Environmental Information, Screening and Scoping (Version 7).

Ref 5-3 The Planning Inspectorate (2018). Advice Note Nine: Rochdale Envelope (Version 3).

Ref 5-4 The Planning Inspectorate (2022). Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (Version 9).

Ref 5-5 The Planning Inspectorate (2020). Advice Note Twelve: Transboundary Impacts and Process (Version 6).

Ref 5-6 The Planning Inspectorate (2019). Advice Note Seventeen: Cumulative Effects Assessment (Version 2).

Ref 5-7 The Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive (Version 1).

Ref 5-8 UK Government (2017). The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 5-9 IEMA (2017). Delivering Proportionate EIA.

Ref 5-10 R.V. Rochdale MBC ex parte Milne (No. 1); and R. V. Rochdale MBC ex parte Tew [1999] and R. v. Rochdale MBC ex parte Milne (No. 2) [2000].

Ref 5-11 UK Government (2008). Planning Act 2008.

Ref 5-12 Department for Communities and Local Government (March 2015). Planning Act 2008: Guidance on The Pre-Application Process for Major Infrastructure Projects.

Ref 5-13 Planning Inspectorate (2023) Transboundary screening undertaken by the Planning Inspectorate (the Inspectorate) on behalf of the Secretary of State (SoS) for the purposes of Regulation 32 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations)

Ref 5-14 Department for Transport (2012) National Policy Statement for Ports

Ref 5-15 The European Community (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive')

Ref 5-16 European Parliament (2009). Directive 2009/147/EC of the European Parliament and of the Council.

Ref 5-17 UK Government (2017). The Conservation of Habitats and Species Regulations 2017.

Ref 5-18 Environment Agency (2017) Water Framework Directive assessment: estuarine and coastal waters.

Ref 5-19 Department for Environment, Food and Rural Affairs (Defra) (2011). Guidance on applying the Waste Hierarchy.

Ref 5-20 UK Government (2009) The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

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6.2 Environmental Statement

Chapter 4: Legislative and Consenting Framework

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 4: Legislative and Consenting Framework

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

4 Legislative and Consenting Framework

4.1 Introduction

4.1.1 This chapter provides a summary of the key legislation, policy and guidance against which the Project is assessed, and which have been considered as part of the Environmental Impact Assessment ("EIA") of the Project and the consenting framework of relevance to the Project.

4.1.2 In addition to the overarching information provided in this chapter, specific legislation, policy and guidance directly relevant to specific environmental topics, are addressed and discussed in the relevant chapter **Chapters 6** to **24** of this Environmental Statement ("ES") **[TR030008/APP/6.2]**.

4.2 Withdrawal of the UK from the EU

4.2.1 UK legislation is influenced by a variety of international agreements (including European Union ("EU") directives, regulations and agreements), which are outlined in this chapter. Following the United Kingdom ("UK") leaving the EU under the terms of the *European Union (Withdrawal Agreement) Act 2020* (Ref 4-1) (the "Withdrawal Act"), broadly, EU-derived domestic legislation and certain EU legislation continue to have effect in domestic law.

4.2.2 In exercise of the powers in the Withdrawal Act, the Government made *The Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018* (Ref 4-2). These regulations provided for *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017* (Ref 4-3) (the "EIA Regulations") to be amended to ensure they functioned correctly after the UK exited the EU. In particular, the amendments updated references to the EIA Regulations to EU law, Member States and related terms to reflect the UK leaving the EU. The regulations do not make substantive changes to the way the EIA regime operates following the UK leaving the EU.

4.3 Legislation

The Planning Act 2008

4.3.1 The *Planning Act 2008* (the "2008 Act") (Ref 4-7) is the primary legislation that establishes the legal framework for applying for, examination and determination of applications for Development Consent Orders ("DCOs") for Nationally Significant Infrastructure Projects ("NSIPs"). As set out in **Chapter 1: Introduction [TR030008/APP/6.2]** the Project is defined as an NSIP under s14(1)(j) and under Part 3, s24(2) and s24(3)(c) of the 2008 Act. The Project is defined as an NSIP as it comprises the alteration of harbour facilities wholly in England and in waters adjacent to England where the effect of the alteration would be to increase the quantity of material the embarkation or disembarkation of which the facilities are capable of handling by at least the relevant quantity of material per year, which in the case of facilities for cargo ships is 5 million tonnes.

4.3.2 A set of regulations prescribe further detail on specific matters. Of particular relevance to the ES are *The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (*Ref 4-25) and the EIA Regulations.

The EIA Regulations

4.3.3 The requirement for an EIA originates from the EU Council *Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment* (Ref 4-8) (the "EIA Directive") (as amended by *Directive 2011/92/EU* (Ref 4-9) and *2014/52/EU* (Ref 4-10). This is directly transposed into English law for NSIPs by the EIA Regulations.

4.3.4 The EIA Regulations identify which projects are likely to have significant environmental effects and would therefore require an EIA, and as described in **Chapter 1: Introduction [TR030008/APP/6.2]**, the Project has been identified as an EIA Project. The EIA Regulations also set out a procedure for assessing, consulting and informing the decision-making process for such projects and require the provision of an ES, which has been submitted alongside the DCO Application for the Project.

4.3.5 Further details on the approach to the EIA are outlined in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

Habitat Regulations

4.3.6 In accordance with *Council Directive 92/43/EEC* of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the "Habitats Directive") (Ref 4-4) and *Directive 2009/147/ES* of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the "Birds Directive") (Ref 4-5), a network of protected sites has been designated by EU member states for the protection of Europe's most valuable and threatened habitats and species. These areas are known as European sites. The *Conservation of Habitats and Species Regulations 2017* (SI 2017 No. 1012) (the 'Habitats Regulations') transpose the EU Directives into UK law (Ref 4-6) and remain in place following the UK's exit from the EU. Relevant aspects of the marine ecology and ornithology assessments for the Project presented in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and **Chapter 10: Ornithology [TR030008/APP/6.2]** have informed the **Without Prejudice Report to Inform Habitats Regulations Assessment (HRA) Derogation [TR030008/APP/7.3]**.

Environmental Permitting (England and Wales) Regulations 2016

4.3.7 Installations which carry out one or more defined prescribed activities are subject to the *Environmental Permitting (England and Wales) Regulations 2016 (EPR).* This legislation requires operators to supply detailed information to the regulator (the Environment Agency) in the form of a permit application and only when the application is fully determined and the relevant environmental permit granted, is operation allowed to commence. Compliance with EPR requires operators to regularly submit information and data such as emissions monitoring results to the

Regulator to confirm the Site is operating within permitted limits (as set out in the environmental permit).

4.3.8 Details of the Environmental Permits required to be obtained are included in **Section 4.6** below and in the **Consents and Agreements Position Statement [TR030008/APP/7.4]**.

Water Framework Directive

4.3.9 The Water Framework Directive ("WFD"), *EC Directive 2000/60/EC* (Ref 4-23) aims to protect and enhance the quality of the water environment across all EU member states. England and Wales have adopted the WFD as national law by the *Water Environment (Water Framework Directive) (England and Wales) Regulations 2017* (Ref 4-24). Following the departure of the UK from the EU these Regulations continue to apply until they are revoked or superseded by new legislation.

4.3.10 The WFD takes a holistic approach to the sustainable management of water by considering the interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem quality is evaluated according to interactions between biological, physico-chemical and hydromorphological elements (or "Quality Elements"). A **Water Framework Directive Compliance Assessment** for the Project is provided in **Appendix 17.A [TR030008/APP/6.4]**.

Marine and Coastal Access Act 2009

4.3.11 *The Marine and Coastal Access Act 2009* ("MCAA") (Ref 4-26) introduced a number of measures including the introduction of a marine planning system as well as establishing the Marine Management Organisation ("MMO"). Under Section 104(2)(aa) of the 2008 Act the Secretary of State must have regard to "*the appropriate marine policy documents"*. The appropriate marine policy documents are the *Marine Policy Statement* ("MPS") (Ref 4-12), March 2011 and the *East Inshore and East Offshore Marine Plans*, April 2014 (Ref 4-17)

4.3.12 The MPS provides the framework for preparing Marine Plans and taking decisions affecting the marine environment. Marine Plans set out how the MPS will be implemented in specific areas. Paragraph 1.3.1 of the MPS sets out that the MPS and marine planning systems will sit alongside and interact with existing planning regimes across the UK. In England and Wales this also includes the DCO regime for NSIPs.

Environment Act 2021

4.3.13 *The Environment Act 2021* (Ref 4-27) serves as enabling legislation for future regulations and policy making in respect of environmental protection. Section 99 and Schedule 15 of the Environment Act relate to the provision of a biodiversity net gain ("BNG") for NSIPs. However, these sections of the Environment Act have not yet come into force (they do so in November 2025), and there is currently no relevant secondary legislation in force stemming from the same. Similarly, the *National Policy Statement for Ports* ("NPSfP") (Ref 4-11) has not yet been updated to include a requirement to provide BNG. As such, BNG is not yet a formal legislative or policy requirement for the Project.

4.4 Policy Context

Overview

4.4.1 The PA 2008 establishes that the primary policy considerations for NSIPs are set out in a series of national policy statements ("NPSs"). The NPSs are produced by the Government pursuant to specific legislative requirements under the PA 2008 to set out policy for nationally significant development in a particular sector and to provide the framework for the decisions on applications for NSIPs in that sector.

4.4.2 In this case, the NPSfP, designated in 2012, is the relevant national policy statement. Whilst the Government has announced a review of the NPSfP, the NPSfP remains extant national policy.

4.4.3 Section 104(2)(aa-d) of the 2008 Act sets out other documents that the Secretary of State must have regard to when deciding an application for development consent. This includes the appropriate marine policy documents, any local impact report submitted by a relevant local authority, any relevant matters prescribed in relation to the Project and any other matters that the Secretary of State identifies as both '*important and relevant*' to the decision.

4.4.4 In the case of the Project, other matters that are important and relevant include recent and relevant UK Government energy and climate change policy including national infrastructure plans and assessments (please see **Appendix E: Government documents that support Net Zero** of the **Planning Statement [TR030008/APP/7.1]**. Other matters that the Secretary of State identifies as both important and relevant may include the policies within the *National Planning and Policy Framework* ("NPPF") (Ref 4-15), *Planning Practice Guidance* ("PPG") (Ref 4-18) and local development plan documents ("DPD") including the *North East Lincolnshire Local Plan 2013 to 2032* (Adopted 2018) ("the Plan") (Ref 4-16).

4.4.5 Where, as here, an NPS has effect, section 104(3) of the PA 2008 requires that the Secretary of State must decide an application for an NSIP in accordance with the relevant NPS, except in a limited number of specified circumstances:

a. Lead to the UK being in breach of its international obligations.

b. Be in breach of any statutory duty that applies to the Secretary of State.

c. Be unlawful.

d. Result in the adverse impacts of the development outweighing the benefits.

e. Any condition prescribed for deciding an application otherwise than in accordance with the NPSfP is met.

4.4.6 Each technical chapter of the ES (**Chapters 6 to 24 [TR030008/APP/6.2**]) refers to the policies from the NPSs that are relevant to the assessment of the environmental effects reported within that chapter. Chapter 7 of the Planning Statement **[TR030008/APP/7.1]** provides an assessment of the Project against the NPSfP, and **Appendix A** of the **Planning Statement [TR030008/APP/7.1]** demonstrates where the contents of the NPSfP have been addressed in the DCO application.

National Policy Statement for Ports

4.4.7 As set out above, the NPSfP 'has effect' in relation to the Project for the purposes of section 104(2)(a) and provides the framework for decisions on proposals for new nationally significant port infrastructure. Importantly, the NPSfP sets out the Government's assessment and conclusions on the need for new port infrastructure. It explains the approach that decision makers should take to proposals, including the main issues which will need to be addressed to ensure that port development is sustainable.

4.4.8 The NPSfP has been considered in detail within **Chapter 3: Need and Alternatives [TR030008/APP/6.2]** and Chapter 7 of the **Planning Statement [TR030008/APP/7.1]** which sets out an overall assessment of the Project against the NPSfP and Appendix A of the Planning Statement identifies where the contents of the NPSfP have been addressed in the Application.

Marine Policy Documents

4.4.9 As the Project is located in the Humber Estuary, the appropriate marine policy documents for the purposes of section 104(2)(aa) are the UK Marine Policy Statement ("MPS") (March 2011) and the East Inshore Marine Plan ("EIMP") (April 2014).

UK Marine Policy Statement

4.4.10 The *UK Marine Policy Statement* ("MPS") (Ref 4-12) sets out a series of high-level marine objectives in order to achieve clean, healthy, safe, productive and biologically diverse oceans and seas. Chapter 3 of the MPS sets out the policy objectives for the key activities that take place in the marine environment which have been considered where relevant in chapter 7 of the Planning Statement. The Project is in accordance with the MPS.

East Inshore and East Offshore Marine Plans

4.4.11 The *East Inshore and East Offshore Marine Plan* (Ref 4-17), sets out, and is underpinned by, a number of strategic objectives and includes policies that guide the regulation, management, use and protection of the marine plan areas. Appendix B of the Planning Statement sets out how the Project accords with the EIMP. The Project is in accordance with the policies set out within the EIMP.

4.4.12 The marine elements of the Project are located within the East Inshore Marine Plan. Adopted policies relevant to the Project are detailed in **Table 4-1**.

Table 4-1: East Inshore and East Offshore Adopted Marine Plan

Policy	Summary
Policy EC1	Economic Benefits
Policy EC2	Employment Benefits
Policy SOC1	Support for health and social well being

Policy	Summary
Policy SOC2	Heritage Assets
Policy SOC3	Terrestrial and Marine Character
Policy ECO1	Cumulative Effects
Policy ECO2	Release of Hazardous Substances
Policy BIO1	Biodiversity Protection
Policy BIO2	Biodiversity and Geological Enhancement
Policy MPA1	Marine Protected Area network
Policy CC1	Climate Change
Policy CC2	Minimising Carbon Emissions
Policy GOV1	Provision of supporting onshore infrastructure
Policy GOV2	Co-existence in the Marine Environment
Policy GOV3	Displacement and Mitigation
Policy DEF1	Ministry of Defence Danger and Exercise Areas
Policy OG1	Consideration of oil and gas production areas
Policy TIDE1	Consideration of tidal energy areas
Policy CCS1	Consideration of CCS areas
Policy PS1	Consideration of static, sea surface infrastructure
Policy PS2	Consideration of static, sea surface infrastructure
Policy PS3	Ports and Shipping
Policy DD1	Dredging and Disposal Areas
Policy AGG1	Consideration of aggregate extraction areas
Policy AGG2	Consideration of aggregate extraction areas
Policy AGG3	Consideration of aggregate extraction areas
Policy FISH1	Fishing Activity
Policy FISH2	Impacts on Fish Population
Policy TR1	Tourism and Recreation during construction and operation

Policy	Summary
Policy TR2	Recreational Activity

4.4.13 Appendix B of the **Planning Statement [TR030008/APP/7.1]** sets out an assessment of the Project against the East Inshore and East Offshore Marine Plans (Ref 4-17).

Other national policy

4.4.14 Other national policy may also be considered 'relevant' and 'important' to the decision-making process by the Secretary of State. In this regard, the overarching NPS for Energy (EN-1), the draft Overarching NPS for Energy (draft EN-1), the NPS for Renewable Energy Infrastructure (EN-3), and the draft NPS for Renewable Energy Infrastructure (draft EN-3) are important and relevant in that they set out the Government's current and emerging policies as to the need for and benefits of new energy infrastructure, including facilities for to the extent they refer to hydrogen production and carbon, capture and storage.

4.4.15 Other government policy documents have been considered in the preparation of the DCO application which the Project has had regard to and are set out at Appendix E of the **Planning Statement [TR030008/APP/7.1]**. These are outlined in below.

The Energy White Paper: Powering our Net Zero Future

4.4.16 The *Energy White Paper: Powering our Net Zero Future* (Ref 4-13) was presented to Parliament in December 2020. The White Paper at its core is a commitment to achieve net zero and tackle climate change, and a clear commitment from the UK Government to invest in new clean energy, with a target of 5 Gigawatt ("GW") of low-carbon hydrogen production capacity by 2030 being set. The Energy White Paper applies to the Project by virtue of it being important and relevant under section 104(2)(d) of the 2008 Act.

British Energy Security Strategy

4.4.17 The UK Government published the *British Energy Security Strategy* (Ref 4-14) in April 2022, which focuses on providing secure, clean and affordable British energy for the long term. The British Energy Security Strategy applies to the Project by virtue of it being important and relevant under section 104(2)(d) of the 2008 Act.

4.4.18 It states that the UK is *"going to produce vastly more hydrogen, which is easy to store, ready to go whenever we need it, and is a low carbon superfuel of the future".* It also outlines that the UK Government *"fully support hydrogen as a relatively frictionless way to decarbonise our lives in the near-term"* and commits to doubling its hydrogen production ambition to 10GW by 2030.

UK Hydrogen Strategy

4.4.19 The *UK Hydrogen Strategy* (Ref 4-28) sets out the Government's approach to developing a thriving low carbon hydrogen sector in the UK and the ambition for 5GW of low carbon hydrogen production capacity by 2030. The Strategy recognises that hydrogen comprises a low carbon solution that is critical to the UK's transition to net zero. The UK Hydrogen Strategy applies to the Project by virtue of it being important and relevant under section 104(2)(d) of the 2008 Act.

National Planning Policy Framework

4.4.20 The latest version of the NPPF was published in July 2021 (Ref 4-15). On 22 December 2022, the Department for Levelling Up, Housing and Communities announced a consultation on revisions to the NPPF. The proposed changes relate to a range of topics including good design and planning for climate change which are relevant to the Project. The Applicant will keep the revisions, where these are applicable to the Project, under review as the Application progresses. The NPPF applies to the Project by virtue of paragraph 5 of the NPPF confirming that it may be a matter that is relevant for the purposes of assessing DCO applications and therefore the Project has regard to the relevant policies of the NPPF as part of the overall framework of national policy.

4.4.21 The NPPF sets out the Government's planning policies for England and how these are to be applied and is a material consideration in planning decisions. Paragraph 5 of the NPPF states that whilst it does not contain specific policies for NSIPs, it may be considered as '*important and relevant*' in the decision-making process in accordance with Section 104 of the 2008 Act. It sets out the UK Government's planning policies for England and how they should be applied. At the heart of the NPPF is a presumption in favour of sustainable development and to deliver this, the framework sets out the UK Government's economic, environmental and social planning policies for England and how these should be applied.

4.4.22 The NPPF is supported by the PPG (Ref 4-18), which is a web-based resource.

4.4.23 Paragraph 7 of the NPPF is clear that the purpose of the planning system is to contribute to the achievement of sustainable development and that the policies that are set out in the Framework, taken as a whole, constitute the UK Government's view of what sustainable development in England means in practice. Paragraph 8 goes on to identify three overarching objectives to achieving sustainable development:

a. An economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure.

b. A social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being.

c. An environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

4.4.24 Sections of the NPPF that are of particular relevance to the scope of the EIA presented in **Chapters 6 to 24 [TR/030008/APP/6.2]** include:

a. Section 2 – Achieving sustainable development.

b. Section 6 – Building a strong, competitive economy.

c. Section 11 – Making effective use of land.

d. Section 12 – Achieving well designed places.

e. Section 14 – Meeting the challenge of climate change, flooding and coastal change.

f. Section 15 – Conserving and enhancing the natural environment.

g. Section 16 – Conserving and enhancing the historic environment.

4.4.25 Relevant content from the NPPF and PPG has been referenced directly in the environmental topic chapters of this ES (**Chapters 6 to 24** of the ES **[TR030008/APP/6.2]**).

4.5 Local Planning Policy

North East Lincolnshire Local Plan 2013 to 2032

4.5.1 Policies in Local Plans are prepared, examined and adopted for the purpose of guiding decision making on Town and Country Planning Act applications, and not applications made under the PA 2008. They can nevertheless provide local context and policies that influence the content of local impact reports which the Secretary of State must have regard to in decision making (section 104(2)(b)).

4.5.2 Additionally, as part of the PA 2008 process, relevant local authorities can submit a Local Impact Report ("LIR") which provides detail of the likely impacts of the project at a localised context. Local planning policy will therefore be an influence on the content of LIRs, which the Secretary of State ("SoS") must have regard to in its decision making (s104 (2)(b) of the PA 2008).

4.5.3 The relevant Local Plan is the North East Lincolnshire Local Plan ("NELLP") (March 2018) (Ref 4-16) which contains land use policies as well as minerals and waste policies. The relevant adopted policies are listed in **Table 4-2**. Where relevant, reference is made in this Planning Statement to policies within the NELLP. Appendix C of the **Planning Statement [TR030008/APP/7.1]** provides a summary of the extent to which the Project accords with relevant policy contained within the NELLP.

4.5.4 The Plan applies to the Project by virtue of it being important and relevant under section 104(2)(d) of the 2008 Act. North East Lincolnshire Council ("NELC") has commenced a review of the adopted plan and a Scoping and Issues Paper (Ref 4-29) was subject to a period of informal public engagement from 26 September 2022 to 4 November 2022. As the scope of the new plan is still being defined, it is at too early a stage to be considered within this ES. However, this will be kept under review as the Project progresses.

Table 4-2: North East Lincolnshire Local Plan Policies

Policy	Summary
Policy 1	Employment Land Supply
Policy 5	Development Boundaries
Policy 7	Employment Allocations – Operational Port Areas
Policy 8	Existing Employment Areas
Policy 11	Skills and Training
Policy 22	Good Design in New Developments
Policy 31	Renewable and Low Carbon Infrastructure
Policy 32	Energy and Low Carbon Living
Policy 33	Flood Risk
Policy 34	Water Management
Policy 36	Promoting Sustainable Transport
Policy 39	Conserving and Enhancing the Historic Environment
Policy 40	Developing a Green Infrastructure Network
Policy 41	Biodiversity and Geodiversity
Policy 42	Landscape
Policy 43	Green Space and Recreation

4.6 Other Consents and Notifications

The Development Consent Order

4.6.1 Consideration has been given to the requisite consenting and approval processes to be included within the DCO Application.

4.6.2 The principal consent for the Project will be the DCO which provides consent for the works and includes powers for compulsory land acquisition and temporary possession, along with other consents and powers.

4.6.3 The Project will include a deemed marine licence within the DCO, as a marine licence granted under the MCAA has been identified as being required. Section 149A of the 2008 Act enables DCOs for projects which affect the marine environment to include provisions which deem marine licences to have been granted subject to specified conditions. The Project would include works below Mean High Water Springs ("MHWS") including, construction of the approach jetty, construction of the jetty head and disposal of the arisings from the capital dredge at sea, subject to there being no contamination, and therefore the Applicant has sought a deemed marine licence, in consultation with the MMO, as part of the DCO.

4.6.4 **The Consents and Agreements Position Statement [TR030008/APP/7.4]** sets out further detail of the other consents and powers incorporated within the **draft DCO [TR030008/APP/2.1]**.

Disapplication of Legislative Provisions

4.6.5 As part of the EIA process, pre-application discussions have been held with relevant stakeholders to seek to agree a position with them on which legislation/consents that can be disapplied. The consents for which s150 is applied for are as follows:

a. Land Drainage Consent from the North East Lindsey Drainage Board under section 23 of the Land Drainage Act 1991.

b. Byelaws for Drainage Consent from the Environment Agency under Paragraph 5 of Schedule 25 of the Water Resources Act 1991 and under the Land Drainage Act 1991.

c. Flood Risk Activity Permit from the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016.

4.6.6 Discussions are ongoing as to disapplication (including with the Environment Agency and North East Lindsey Drainage Board in relation to the matters set out in **Paragraph 4.6.5**) and also whether further consenting requirements will be disapplied in addition to those listed in **Paragraph 4.6.5**. As a result, some consents listed in the **Consents and Agreements Position Statement [TR030008/APP/7.4]** may ultimately be disapplied. Further details are presented in the **Consents and Agreements Positions Statement [TR030008/APP/7.4]**.

4.6.7 Maintenance dredging would also be undertaken by the Project. The Applicant has statutory powers to dredge being designated as a Harbour Authority under s.75 of the MCAARef 4-26. The Applicant also has an existing maintenance dredge disposal marine licence (L/2014/00429/4) that relates to such activity at the Port. It is intended that this licence will be renewed by the end of 2025 and extended to include the area for maintenance dredging for the Project. An assessment of the environmental impacts associated with both the capital dredge and the additional maintenance dredge and disposal requirements is included in this ES.

4.6.8 Flood risk activities are regulated under the *Environmental Permitting (England and Wales) Regulations 2016* (Ref 4-22). An environmental permit is normally required if works are proposed on or near a 'main river', on or near a flood defence structure (including a sea defence), or within a flood plain. It is considered that an environmental permit is required for the Project in respect of the construction works associated with the flood defence. As explained above, the Applicant is therefore seeking to disapply the requirement to apply for a permit relating to flood defence work within the DCO.

4.6.9 A Flood Risk Assessment ("FRA") has been prepared and is provided at **Appendix 18.A [TR030008/APP/6.4]**. This assessment has given consideration to both the flood risk to the proposed development and the implications of the development for flooding elsewhere. The outputs of the FRA have informed **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

Other Environmental Permits, Consents, Licences and Notifications

4.6.10 An environmental permit may be required, during the construction phase of the Project, it became necessary to undertake any groundwater pumping/dewatering. Again, in such circumstances an environmental permit for such activity would be sought and obtained after the making of the DCO but prior to the relevant works taking place. If such a permit were required, the Applicant does not consider that there are currently any reasons why such a permit would not subsequently be granted.

4.6.11 An environmental permit may also be required for activities at the hydrogen production facility which fall under Schedule 1 (production of inorganic chemicals) of the *Environmental Permitting (England and Wales) Regulations 2016* (Ref 4-22). As above, the Applicant does not consider that there are currently any reasons why such a permit would not subsequently be granted.

4.6.12 It is not currently anticipated that an environmental permit will be required in respect of any waste management activities. However, in the event that one were required, a hazardous waste assessment would be undertaken and the contractor will be responsible for ensuring that the necessary permit application or applications are made prior to the relevant works taking place. Again, if such a permit were required, the Applicant does not consider that there are currently any reasons why such a permit would not subsequently be granted.

4.6.13 In addition to the above, the following other consents are required or requirements apply in respect of the Project:

a. *Protected species licences (The Conservation of Habitats and Species Regulations 2017)* (Ref 4-19), for bats and water voles may be required.

b. *Hazardous Substances Consent (The Planning (Hazardous Substances) Regulations 2015)* (Ref 4-20).

c. *Control of Major Accidents and Hazards (COMAH) pre-construction notification (The Control of Major Accident Hazardous Regulations 2015)* (Ref 4-21).

d. COMAH pre-operation notification (The Control of Major Accident Hazardous Regulations 2015) (Ref 4-21)

e. COMAH Safety Reports (Regulation 8 and 9 of The Control of Major Accident Hazardous Regulations 2015) (Ref 4-21).

f. *Pipelines: Pre construction notification (Pipelines Safety Regulations 1996) (Ref 4-30)*

g. *Prior consent to carry out noise generating activities during construction / Construction Noise Consent (Section 61 of the Control of Pollution Act 1974) (Ref 4-31)*

h. *Transport of Abnormal Loads Permit (The Roads Vehicles (Authorisation of Special Types) (General) Order 2003 (Ref 4-32); The Road Traffic Act 1988 (Ref 4-33)).*

i. Building Regulations Approval (The Building Regulations 2010 (as amended) (Ref 4-34)

j. Discharge of trade effluent consent (Water Industry Act 1991) (Ref 4-35)

4.6.14 These other consents and approvals are considered and discussed in the relevant topic chapters and summarised in the Consents and Agreements Position Statement.

4.6.15 In relation to the Hazardous Substances Consent, it is anticipated that the HSE, as statutory consultee, will “advise against” the grant of consent due to the existing residential properties on Queen’s Road. Air Products are therefore undertaking negotiations with affected landowners with a view to acquiring their properties by agreement. The **draft DCO [TR030008/APP/2.1]** includes compulsory acquisition powers to be exercised in the event that acquisition by agreement is unsuccessful. It also includes a commitment to acquiring the properties and securing the cessation of residential use ahead of the hydrogen production facility becoming operational.

4.6.16 Once the properties are no longer in residential use it is anticipated that the HSE will withdraw its “advise against” and NELC will be able to issue the consent. Subject to the acquisition of the residential properties and cessation of their residential use (see the **Statement of Reasons [TR030008/APP/3.2]** for further information in this regard), Air Products do not consider there will be any further impediment to obtaining this consent.

4.6.17 The Applicant has no reason to believe that any of the necessary consents outlined above will not be obtained and therefore in examining and determining the DCO Application, the Examining Authority and the Secretary of State should assume these processes would be completed as per the relevant prescribed process and consents forthcoming, as per paragraph 4.11.8 of the NPSfP.

4.7 Summary

4.7.1 The NPSfP (Ref 4-11), and the MPS (Ref 4-12) represent the principal policy documents against which the DCO Application for the Project should be determined. They set out a number of generic impacts and considerations relevant to the scoping of projects, and assessment principles with which applications for NSIPs are expected to comply.

4.8 References

Ref 4-1 The Stationery Office Limited (2020). European Union (Withdrawal Agreement) Act 2020.

Ref 4-2 The Stationery Office Limited (2018). The Environmental Assessment and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018.

Ref 4-3 The Stationery Office Limited (2017). The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 4-4 The European Community (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive').

Ref 4-5 European Parliament (2009). Directive 2009/147/EC of the European Parliament and of the Council.

Ref 4-6 UK Government (2017). The Conservation of Habitats and Species Regulations 2017.

Ref 4-7 The Stationery Office Limited (2008). Planning Act 2008.

Ref 4-8 European Commission (1985). Council Directive of 27 June 1985 of the assessment of the effects of certain public and private projects on the environment (85/ 337/ EEC).

Ref 4-9 European Commission (2011). Directive 2011/ 92/ EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.

Ref 4-10 European Commission (2014). Directive 2014/ 52/ EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/ 92/ EU on the assessment of the effects of certain public and private projects on the environment.

Ref 4-11 Department for Transport (2012). The National Planning Policy Statement for Ports.

Ref 4-12 The Stationery Office Limited (2011). UK Marine Policy Statement.

Ref 4-13 Department for Business, Energy & Industrial Strategy (2020). Energy White Paper: Powering our Net Zero Future.

Ref 4-14 Department for Business, Energy & Industrial Strategy (2022). British Energy Security Strategy.

Ref 4-15 Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework.

Ref 4-16 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan 2013 to 2032 (Adopted 2018).

Ref 4-17 Maritime Management Organisation (2016). East Inshore and East Offshore Marine Plans.

Ref 4-18 Ministry of Housing, Communities and Local Government (2021). Planning Practice Guidance.

Ref 4-19 The Stationery Office Limited (2017). The Conservation of Habitats and Species Regulations 2017.

Ref 4-20 The Stationery Office Limited (2015) The Planning (Hazardous Substances) Regulations 2015.

Ref 4-21 The Stationery Office Limited (2015) The Control of Major Accident Hazardous Regulations 2015.

Ref 4-22 The Stationery Office Limited (2016) The Environmental Permitting (England and Wales) Regulations 2016.

Ref 4-23 European Commission (2000). The EU Water Framework Directive – Integrated River Basin Management for Europe (2000/60/EC).

Ref 4-24 The Stationery Office Limited (2017). The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Ref 4-25 The Stationery Office Limited (2009). The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.

Ref 4-26 The Stationery Office Limited (2009). The Marine and Coastal Access Act 2009.

Ref 4-27 The Stationery Office Limited (2021). The Environment Act 2021.

Ref 4-28 The Stationery Office Limited (2021). UK Hydrogen Strategy.

Ref 4-29 North East Lincolnshire Council (2022). North East Lincolnshire Local Plan Review Scoping and Issues Paper.

Ref 4-30 The Stationery Office (1996). The Pipelines Safety Regulations 1996.

Ref 4-31 The Stationery Office (1974). Section 61 Control of Pollution Act 1974.

Ref 4-32 The Stationery Office (2003). The Road Vehicles (Authorisation of Special Types) (General) Order.

Ref 4-33 The Stationery Office (1988). The Road Traffic Act 1988.

Ref 4-34 The Stationery Office (2010). The Buildings Regulations 2010.

Ref 4-35 The Stationery Office (1991). Water Industry Act 1991.

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6.2 Environmental Statement

Chapter 6: Air Quality

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

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6.2 Environmental Statement

Chapter 6: Air Quality

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

6 Air Quality

6.1 Introduction

6.1.1 This chapter presents the findings of the assessment of the likely significant effects of the construction, operation and decommissioning of the Project on air quality ("AQ"). For more details about the Project, including construction methodology, layout and lifespan and defined Site areas, refer to **Chapter 1: Introduction** and **Chapter 2: The Project [TR030008/APP/6.2]**.

6.1.2 As interrelationships exist with other assessments in relation to potential effects on AQ, reference should be made to the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 8: Nature Conservation (Terrestrial Ecology)** – Where the significance effect of AQ impacts on terrestrial habitats are considered.

b. **Chapter 9: Nature Conservation (Marine Ecology)** – Where the significance effect of AQ impacts on marine habitats are considered.

c. **Chapter 11: Traffic and Transport** – Due to the consideration of construction phase and operational phase road traffic emissions within the AQ assessment reported in this chapter.

d. **Chapter 12: Marine Transport and Navigation** – Due to the consideration of vessel emissions within the AQ assessment reported in this chapter.

e. **Chapter 24: Human Health and Wellbeing** – Where the significance effect of AQ impacts on human health and wellbeing are considered.

6.1.3 This chapter is also supported by the following figures and appendices:

a. **Figure 6.1: Air Quality Study Area** – showing the location of AQ sensitive receptors and AQ monitoring locations in relation to the Site Boundary of the Project **[TR030008/APP/6.3]**.

b. **Figure 6.2: Construction Phase Assessment** – showing construction dust receptors and the areas within which unmitigated impacts may occur **[TR030008/APP/6.3]**.

c. **Figure 6.3: Operational Phase Impacts** – showing operational phase receptors and the magnitude of operational impacts **[TR030008/APP/6.3]**.

d. **Appendix 6.A: Construction Phase Assessment Method** – detailing the approach to the construction phase assessment **[TR030008/APP/6.4]**.

e. **Appendix 6.B: Operational Phase Assessment Method** – detailing the approach to the operational phase assessment **[TR030008/APP/6.4]**.

6.1.4 The AQ assessment is supported by other topic chapters in the Environmental Statement ("ES"), including traffic data generated for the assessment reported in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**. AQ impacts also have the potential to affect nature conservation sites. The significance of any effect on such sites and protected features is described in **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]** and **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**, and within the

Shadow Habitats Regulations Assessment ("HRA") [TR030008/APP/7.6] for habitats of relevance to that document.

6.2 Consultation and Engagement

6.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the AQ assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on AQ. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

6.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

6.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

6.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation is summarised in **Table 6-1**. The full responses to consultation comments are included within the **Summary of Consultation Responses** document **[TR030008/APP/5.1]**.

Table 6-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Air Quality Chapter refers to modelling of multiple emission release heights from flare stacks and/ or vents to encourage optimal dispersion of emissions, as well as use of Selective Catalytic Reduction. The project description of the ES needs to describe the energy plant in detail. The maximum height of any flare stack(s) must be provided and any assumptions regarding minimum flare stack heights should also be set out.	The Project is described in **Chapter 2: The Project [TR030008/APP/6.2]** and includes details of the energy plant. Dispersion model input parameters, including modelled flare stack height, are provided in **Appendix 6.B [TR030008/APP/6.4]**. Requirement 4(4) of the draft Development Consent Order ("DCO") secures minimum heights for the ammonia tank flare stack and hydrogen production unit flare stack.
		The study area is based on screening criteria for assessments of dust and road traffic emissions. The Scoping Report does not discuss how the study area would be established for the assessment of emissions to air from vessel movements and energy plant process contributions. The ES should describe the study area for the assessment, and this should be established in line with relevant guidance and in consultation with relevant consultation bodies. The study areas should be based on the zone of influence ("ZoI") for all sources associated with the Project including on site plant/machinery and vessel movements serving the site. Figure(s) should be used to illustrate the extent of the study area.	The study area for energy plant is described in **Section 6.5** and is based on Environment Agency guidance. There is no standard guidance that defines a suitable study area for the consideration of vessel emissions. Instead, the assessment reports impacts that include docked vessel emissions at the worst affected air quality sensitive receptors located in each direction from that vessel and all other sources modelled. The study area used to define the assessment of emissions is described in **Section 6.5**. The extent of the study area is presented in **Figure 6.1 [TR030008/APP/6.3]** and shows

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			the spatial extent of AQ sensitive receptors considered in the assessment.
		The Scoping Report proposes to rely on existing air quality survey data. The Inspectorate supports the use of existing data in principle; however the Applicant should ensure that the data is up to date and geographically accurate and is advised to seek agreement with North East Lincolnshire Council ("NELC") on the survey requirements.	The assessment has been informed by existing data made available by NELC, data published by Defra, and project specific nitrogen dioxide data gathered within the Project study area. No direct AQ-specific consultation has been held with NELC to date, although all air quality data gathered by NELC is publicly available from their Annual Status Reports, which are published online. Monitoring data collected in the last calendar year is presented in **Section 6.5.**
		The Scoping Report does not specify which pollutants would be included in the assessments and provides baseline information on NO_2 and PM_{10} only. The Applicant is advised to seek agreement with NELC on the range of pollutants to be included in the assessments, this should include consideration of $PM_{2.5}$, NO_X, NH_3 and SO_2 where relevant.	NELC has been consulted as part of the Scoping process. Pollutants of concern considered in the AQ assessment for the ES extend beyond nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of 10 and 2.5 microns or less (PM_{10} and $PM_{2.5}$), to also include oxides of nitrogen (NO_X), ammonia (NH_3), sulphur dioxide (SO_2), carbon monoxide (CO) and nitrogen deposition. The range of pollutants modelled is set out in **Table 6-5**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The Scoping Report seeks to scope out impacts arising from decommissioning of landside infrastructure on the grounds that the impacts would be uncertain, working practices unknown, and impacts are likely to be no worse than those arising from the construction and operation phases. Paragraphs 2.4.48 – 2.4.49 commit to producing an Outline Decommissioning Strategy with the application to be secured within the DCO. Subject to the provision of this Outline Decommissioning Plan, the Inspectorate agrees to scope out this matter from the ES.	This is noted by the Applicant.
		Paragraph 5.6.8 suggests that the operational phase assessment would consider emissions from vessel energy plant when vessels are docked at the facility, and not include an assessment of emissions from vessels in transit. The Scoping Report does not provide an estimate of operational vessel movements therefore the Inspectorate is not in a position to scope out an assessment of operational vessel movements. The Inspectorate considers that the air quality assessment should include the emissions to air from operational vessel movements where significant effects are likely to occur and that such consideration should be based on the application of relevant threshold criteria.	There is limited guidance available on the screening of marine vessel emissions for the purpose of air quality assessments. Department for Environment, Food & Rural Affairs ("DEFRA") guidance (LAQM TG22 (Ref 6-8)) provides screening criteria for use by Local Authorities in their Local Air Quality Management ("LAQM") responsibilities. The purpose of this criteria is to assist Local Authorities to establish whether any port extension requires further review and assessment to identify an exceedance of an air quality objective. The Project will not meet this screening criteria set by DEFRA guidance for LAQM matters, based on the number of vessel movements per year and the proximity of sensitive receptors (see **Section 6.4**, **Paragraph 6.8.45**). This suggests that vessel emissions based on the scale of the

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			Project operations and proximity of receptors is unlikely to be an issue in isolation. To account for the impact of vessels in combination with other onsite sources, the AQ assessment accounts for vessel emissions when vessels are docked. The reason being that when docked, vessel engine emissions are static and assumed to be in operation 7,008 hours per year, based on an assumed theoretical maximum of 292 vessel calls per year and each call lasting 24 hours, therefore having the potential to impact on the same location for a prolonged period of time. The assessment does not account for vessel emissions when vessels are in motion. Such emissions are transient and intermittent – potentially only affecting individual habitat for the limited period of time in which a vessel maneuvers past a sensitive location, and only when the wind is blowing from the vessel towards that location. Based on the speed of vessels accessing the Project (~10 to ~20 knots (~11 to ~23 mph)) and the frequency of predicted vessel movements (0.8 calls per day), impacts at any one location are likely to occur for a matter of minutes per day (~2% of the year). Such an impact is considered unlikely to contribute to a significant effect.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			The assessment methodology for vessel emissions is discussed in **Section 6.4 Paragraphs 6.4.26** to **6.4.35** and **Appendix 6.A [TR030008/APP/6.4]**.
		The effect of odour during operation has not been scoped into the assessment or reasons provided why this has been scoped out. This matter should be considered as part of the assessment made for air quality effects, as well as part of the health and well-being assessment, should significant effects be likely to occur.	The Project is not anticipated to be a notable source of odour – the onsite process operates with full containment and only in the event of an emergency if other prior measures such as control and containment fail would any NH_3 emissions be flared. Any odour will be as a result of fugitive emissions from leaks. A qualitative assessment of odour emissions has been undertaken with reference to Institute of Air Quality Management ("IAQM") Odour guidance (Ref 6-25), the methodology for which is set out in **Paragraph 6.4.22** to **6.4.25**. **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]** considers the potential health and wellbeing impacts arising from odour.
Scoping Report August 2022	Natural England	We note and welcome the report's reference to the assessment of air quality issues arising from traffic generation during the construction and operational lifetime of the scheme (para 5.2.1) and offer the following comments: Air quality in the UK has improved over recent decades but air pollution remains a significant issue. For example, approximately 85% of protected nature conservation sites are currently in	Natural England guidance document NE001 is discussed in **Paragraph 6.4.15, Paragraph 6.6.16** and **Paragraph 6.8.39**. The construction of the Project will increase traffic movements on the local road network to the extent that the IAQM/Environmental Protection UK ("EPUK") screening criteria is

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		exceedance of nitrogen levels where harm is expected (critical load) and approximately 87% of sites exceed the level of ammonia where harm is expected for lower plants (critical level of 1µg) [1].A priority action in the England Biodiversity Strategy is to reduce air pollution impacts on biodiversity. The Government's Clean Air Strategy also has a number of targets to reduce emissions including to reduce damaging deposition of reactive forms of nitrogen by 17% over England's protected priority sensitive habitats by 2030, to reduce emissions of ammonia against the 2005 baseline by 16% by 2030 and to reduce emissions of NO_x and SO_2 against a 2005 baseline of 73% and 88% respectively by 2030. Shared Nitrogen Action Plans ("SNAPs") have also been identified as a tool to reduce environmental damage from air pollution. The planning system plays a key role in determining the location of developments which may give rise to pollution, either directly, or from traffic generation, and hence planning decisions can have a significant impact on the quality of air, water and land. The ES should take account of the risks of air pollution and how these can be managed or reduced. This should include taking account of any strategic solutions or SNAPs, which may be being developed or implemented to mitigate the impacts of air quality. Further information on air pollution impacts and the sensitivity of different habitats/designated sites can be found on the Air Pollution Information System (www.apis.ac.uk) ("APIS"). Natural England has produced guidance for public bodies to help assess the impacts of road traffic emissions to air quality capable of affecting European Sites. Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations -NEA001 (Ref 6-34)	exceeded on Queens Road and the A1173, between Queens Road and the A180. There are no nature conservation sensitive receptors located within 200m of this route, nor any of the lesser affected routes that experience traffic impacts at a level below the screening criteria. During the operation of the Project, there are no links that would experience an increase in traffic flow on the local road network or Strategic Road Network ("SRN") to the extent that the respective IAQM/EPUK or National Highways screening criteria is exceeded. The assessment methodology with regards to road traffic emissions described in **Paragraph 6.4.14** to **6.4.21** and **Appendix 6.B [TR030008/APP/6.4]**. Assessment results are set out in **Table 6-16** and **Paragraphs 6.10.7** and **6.10.8**. The significance of any effect is described in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		With regard to the construction phase the focus on PM_{10}, set out in this para (5.6.2) should be reviewed with regard to its suitability for ecological receptors including designated sites in the context of the APIS information (site relevant critical loads).NO_2 and $PM_{2.5}$ should also be included in this assessment.	The construction phase assessment has been undertaken in line with relevant guidance published by the IAQM (Ref 6-23) and includes consideration of relevant impacts at sensitive habitats. The assessment methodology for the construction phase is set out in **Paragraph 6.4.5** to **6.4.8** and **Appendix 6.A [TR030008/APP/6.4]**. NO_2 and $PM_{2.5}$ are considered with regards to combustion emissions, as set out in **Paragraph 6.4.12, 6.4.14** and **6.4.26.**
		We note the applicants intention to consult Natural England, Should the applicant wish to explore options for avoiding or mitigating effects on the natural environment with Natural England, we recommend that they use our Discretionary Advice Service.	This is noted by the Applicant.
PEI Report January 2023	Natural England	[1] Potential air quality impacts from traffic during construction and operation phases Paragraph 6.3.13 states that Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) guidance has been used to inform the assessment. Natural England guidance NEA0012 should also be followed when undertaking the assessment. [2] Ammonia (NH_3), along with nitrous oxides (NOx), can contribute to N-deposition in the soil and potential eutrophication of habitats. Whereas background levels of nitrous oxides have shown a steady decline over time due to reduced emissions from vehicles and other sources, levels of ammonia have remained relatively stable over the last 30 years. Ammonia can be emitted from vehicle exhaust	[1] It is assumed that the Natural England reference to the guidance “NEA0012” is intended to refer to the guidance NEA001. The method of assessment of road traffic emissions impacts is set out in **Paragraph 6.4.14** to **6.4.21** and **Appendix 6.B [TR030008/APP/6.4]**. The assessment is undertaken in line with this (Ref 6-34) and other relevant and appropriate guidance (Ref 6-32). The Natural England guidance document titled *Natural England’s approach to advising*

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		emissions as a by-product of the catalytic conversion process designed to reduce emissions of nitrogen oxide. [3] Ammonia emissions from road traffic could make a significant difference to nitrogen deposition close to roads. As traffic composition transitions toward more petrol and electric cars (i.e., fewer diesel cars on the road), catalytic converters may aid in reducing NOx emissions but result in increased ammonia emissions (see https://www.aqconsultants.co.uk/news/february-2020-(1)/ammonia-emissions-from-roads-for-assessing-impacts). Therefore, we advise that further consideration is needed within the air quality assessment. [4] There are currently two models which can be used to calculate the ammonia concentration and contribution to total N deposition from road sources. One of these models is publicly available and called CREAM (Air Quality Consultants - News - Ammonia Emissions from Roads for Assessing Impacts on Nitrogen-Sensitive Habitats (aqconsultants.co.uk), and there is another produced by National Highways. [5] Paragraph 6.8.47 states that it is likely that during operation the traffic movements will equal approximately 96 two-way movements per day, which is below the significance threshold identified in Natural England guidance NEA001. We recommend that this is still considered within the Habitat Regulations Assessment ("HRA"), particularly if these numbers are subject to change.	*competent authorities on the assessment of road traffic emissions under the Habitats Regulations* (NEA001) focuses on the road traffic impact of emissions on sensitive habitat with a European designation. It states that there are 4 sequential steps to consider. The first three steps are summarized as follows: Step 1 is consideration of whether emissions from a project are likely to reach and impact on a European designation, based on the distance between the source and the designation. Step 2 and Step 3 of the guidance require confirmation as to whether the qualifying species within a designated site that are within 200m of a road are sensitive to air pollution and can be exposed to the road's traffic emissions. For the Project, there are no roads within 200m of a European designation that experience an increase in traffic flow because of the Project's construction or operation. Therefore, in accordance with the relevant Natural England guidance, there is no requirement to proceed to Step 4. However, the impact of Project emissions on air quality sensitive habitats within the Humber Estuary Special Area of Conservation ("SAC") has been quantified with the results presented in **Chapter 9: Nature Conservation (Marine Ecology)** and the **Shadow HRA [TR030008/APP/7.6]**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			[2] Noted. [3] The assessment reported in **Section 6.8** includes consideration of NH_3 emissions as appropriate, where it is released because of ammonia slip from site emissions and emissions from vessels that comply MARPOL Regulation 13 Tier III emission standards. Ammonia emissions from vehicle emissions have not been quantified as part of this assessment. The reason for this is because there are no nature conservation sensitive habitats with 200m of a road affected by the Project. The nearest road to an SAC/SPA/RAMSAR site that exceeds the National Highways DMRB screening criteria (Ref 6-33) during the construction phase is Queens Road, to southwest of the West Site egress. This road is approximately 1.5km away from the nearest SAC and approximate 3km from the nearest section of sensitive habitat within that SAC/SPA/RAMSAR site. During the operational phase, there are no roads that exceed the DMRB screening criteria. [4] Modelled road traffic emissions do not account for ammonia due to the distance of any affected road from a sensitive habitat. [5] Noted.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Paragraph 6.8.32 states that although the construction vessel working area is adjacent to the SAC, receptors sensitive to air pollution impacts are not present in the vicinity of the vessels, and the nearest sensitive receptor (saltmarsh) is 3km from the location. Natural England advises that this should be clearly explained within the HRA.	This is explained in **Table 1** of the **Shadow HRA[TR030008/APP/7.6]**. Air quality sensitive receptors within the SAC included in the air quality assessment are illustrated on **Figure 6.1 [TR030008/APP/6.3]**.
		We note that at 6.8.7 a 50m buffer for ecological receptors within nature conservation sites has been used. Natural England advises that designated site ecological receptors within 200m should be assessed for potential impacts from dust emissions. However, we agree with paragraph 6.8.19 which states that tidal mudflat has been identified as not being sensitive to dust impacts, therefore we advise that if all ecological receptors within 200m are mudflat then this impact pathway can be screened out.	Noted by the Applicant. The construction dust assessment is reported in **Paragraph 6.8.3** to **6.8.22** and follows an appropriate methodology based on relevant guidance (Ref 6-23).
		Natural England notes that paragraphs 6.8.38 – 6.1.2 consider the combined emissions from both the marine vessel emissions and the landside plant emissions together, it would be useful to understand the contributions from each of these impact pathways, as this will be useful to inform the effectiveness of any mitigation put in place.	**Section 6.8** reports the air quality impact assessment, including the contribution from vessel emissions and landside plant (see **Paragraph 6.8.60**). The mitigation measures are set out in **Sections 6.7** and **6.9**. Those measures will target sources where modelled impacts identify that mitigation is required and reduce emissions through the implementation of good practice.
		Paragraph 6.3.21 states that "NO_2 and NH_3 also contribute to nitrogen deposition, which is another pollutant that is harmful to nature conservation sites. Flares on site will be required to operate in an emergency or during plant start-up to burn off the release of NH_3, which will therefore also be a source of NOx emissions". We	**Section 6.4** sets out and considers all emissions sources and pollutants with the potential to contribute to a significant effect, with reference to applicable guidance. **Paragraph 6.4.29** and **6.4.33** discuss

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		advise that as well as contributing to N-deposition, the release of NH_3 may also lead to direct damage to vegetation, and it is not clear if there is potential for release of unreacted ammonia through this process.	sources that emit NH_3 and their contribution to NH_3 concentrations and the contribution of NH_3 to N-deposition.
		We note that PEIR Figures 6.3c and 6.3d include the ecological receptors used as part of the air quality assessment, however, we cannot find any explanation of the reasons for picking these receptors and the habitat types represented at each receptor.	The selection of AQ sensitive receptors is reported in **Paragraph 6.4.36** to **6.4.40** and **Section 6** of **Appendix 6.B [TR030008/APP/6.4]**.
		We note that ecological receptor E2 appears to be located at North Killingholme Haven Pits Sites of Special Scientific Interest ("SSSI"). Assessment should be undertaken to determine potential impacts to the SSSI.	Noted. The assessment described in **Section 6.8** includes consideration of impacts on the North Killingholme Haven Pits SSSI, which is receptor O_E11, as illustrated on **Figure 6.1 [TR030008/APP/6.3]**.
		The PEIR Figures 6.3c and 6.3d indicate that the process contributions exceed 1% of the environmental benchmarks for annual mean NOx and N-deposition at several of the ecological receptors. There does not appear to be figures for annual mean NH3 and sulphur dioxide. At this stage, the assessment provided is very preliminary and therefore Natural England will review in further detail once we are consulted on the ES and HRA.	**Figure 6.3** illustrates the impact and spatial variation of impacts for annual mean NO_X impacts and nitrogen deposition rate impacts. The figure does not illustrate the impacts of NH_3 or sulphur dioxide, because the contribution of those pollutants by the Project is negligible. The impact of pollutants not illustrated in **Figure 6.3** are presented in **Table 6-19** and **Table 6-20** and **Appendix 6.B Section 10 [TR030008/APP/6.4]**.
		Natural England notes at paragraph 6.8.45 of the PIER that it concludes that "the additional predicted contribution from nitrogen emissions from the Project does not result in any exceedance of the Critical Load range for saltmarsh, and it is concluded that there will	At the time the PEI Report assessment was undertaken, APIS had published a Critical Load for saltmarsh habitat as 20-30 kgN/ha/yr. Since the publication of the PEI

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		be no adverse effect on the Humber Estuary designated site." However, we consider that detailed ecological justification would be required to understand the reasoning for not using the lower critical load range for upper saltmarsh. This should be based on habitat surveys and frequency of tidal inundation. We would find it useful for the HRA to refer to the notified habitat features of the SAC. Even using the higher critical load, we note that the process contribution for annual mean NOx is predicted to be 11% of the critical load, at ecological receptor (E11) defined as worst affected. E11 receptor is also adjacent to the Able Marine Energy Compensation site (Cherry Cobb Sands Tidal Exchange/ managed realignment site), which is due to be constructed. Saltmarsh surveys have been undertaken recently as part of this project.	Report, APIS have revised the Critical Load for saltmarsh habitat as 10-20 kgN/ha/yr. The Critical Load range relevant to that habitat considered in this assessment is 10 to 20 kgN/ha/yr. This comment from Natural England refers to the higher Critical Load in relation to process contribution for annual mean NO_X. The Applicant notes that there are no lower or higher criteria for annual mean NO_X and the one appropriate standard is the Critical Level of 30 µg/m^3. The Applicant notes that Natural England highlight the impact reported in the PEI Report for receptor R11 and states that R11 is adjacent to the Able Marine Energy Compensation Site. The Applicant notes that receptor R11 in the PEI Report was located on the northern shore of the Humber Estuary. The Able Marine Compensation Site is located on the southern shore and is approximately 5km away from the location of R11. The assessment reported in **Section 6.8** provides the description of impacts on nature conservation sites (see **Table 6-19** and **Table 6-20** and **Appendix 6.B Section 10 [TR030008/APP/6.4]**). The effect and relevant justification for the determination of whether effects are significant or not is provided in **Chapter 9: Nature**

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			Conservation (Marine Ecology) [TR030008/APP/6.2] and the **Shadow HRA [TR030008/APP/7.6]**. The impact of cumulative emission sources is provided in **Appendix 25.C Assessment of Cumulative Effects [TR030008/APP/6.4]**
Scoping Report August 2022	Environment Agency	The Environment Agency will only undertake a detailed review of any air quality assessment when determining an application for an Environmental Permit. We are aware that there are receptors in the area, which are sensitive to dust (e.g. storage of new cars) and it may be prudent for the developer to be aware of this and engage with relevant local stakeholders. Paragraph 5.6.13 does not make explicit reference to Air emissions risk assessment for your environmental permit - **https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit**, however, it is referred to in paragraph 5.6.8. This guidance (although written for environmental permitting) will also be useful for the assessment.	The assessment does include consideration of potential dust impacts on dust sensitive receptors. The dust assessment method is described in **Paragraph 6.4.5** to **6.4.8** and **Appendix 6.A [TR030008/APP/6.4]** and follows industry standard guidance (Ref 6-23). Environment Agency guidance is referred to in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]** to inform the method of assessment for point source emissions.
Scoping Report August 2022	East Lindsey District Council	"I can advise that this authority has no comments to make."	This is noted by the Applicant.
Scoping Report August 2022	North East Lincolnshire Council	AQ Officer has read and reviewed the proposed EIA Scoping report, they are happy with the suggested approach and methodology used to assess the potential air quality impacts and effects of the Project on human receptors.	This is noted by the Applicant.
PEI Report January 2023	Polynt Composites	Other non-COMAH hazard risks to human health, such as worsening air quality, are also not dealt with adequately in the consultation documentation. Increased levels of harmful dioxins	The impact of emissions from increased traffic movements is considered in **Paragraph 6.8.37** to **6.8.42** and **Table 6-16**, with reference to relevant guidance

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		caused by both increased traffic (queuing traffic in particular), must be fully assessed and mitigated.	published by the IAQM (Ref 6-32), National Highways (Ref 6-33) and Defra (Ref 6-8). In line with that guidance, the assessment focuses on the primary pollutants of concern from such emissions.
PEI Report January 2023	Immingham Power Limited	The [Immingham Power Limited] site has external air intakes for cooling and combustion air. Increased airborne particulates and pollution from nearby construction have a detrimental effect on the equipment. Would you install dust monitoring on our site?	The assessment of construction dust impacts determines the level of mitigation required to ensure that a significant effect will not occur, in line with IAQM guidance (Ref 6-23). Mitigation measures are set out in **Paragraph 6.7.7** and **Section 6.9** and included within the **Outline Construction Environmental Management Plan [[TR030008/APP/6.5]**. Details on the required level of dust monitoring are provided within the **Outline Construction Environmental Management Plan [TR030008/APP/6.5]**.
PEI Report January 2023	Local Resident (living within approx. 10km of the project)	The new development will bring noise with the operational phase and contribute to an inhabited area which already suffers poor air quality.	**Paragraph 6.6.2** to **Paragraph 6.6.6** describes the existing and future baseline air quality conditions experienced by receptors in the vicinity of the Project and sources of emissions to air associated with it. **Section 6.8** presents an assessment of the impact of emissions during the construction and operation of the Project and the effect at local AQ sensitive receptors. Measures to avoid significant adverse effects and minimise and mitigate other adverse effects

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			at receptors is presented in **Sections 6.7** and **6.9**. These sections demonstrate that existing air quality at inhabited areas of the study area are of a good standard and the effect of Project impacts is not significant.
PEI Report January 2023	Local Resident (living within approx. 10km of the project)	Concern for increased dust and noise, especially traffic noise. Concern for the environment	**Section 6.8** presents an assessment of the impact of emissions during the construction and operation of the Project and the effect on local AQ sensitive receptors. Measures to avoid significant adverse effects and minimise and mitigate other adverse effects at receptors are presented in **Sections 6.7** and **6.9**. These sections demonstrate that existing air quality within the study area is of a good standard and the effect of Project impacts is not significant.

6.3 Legislation, Planning Policy and Guidance

6.3.1 **Table 6-2** presents the legislation, policy and guidance relevant to the air quality assessment and details how their requirements have been met.

Table 6-2: Relevant legislation, policy and guidance regarding air quality

Legislation/Policy/Guidance	Consideration within the assessment
Clean Air for Europe	
The Clean Air for Europe ("CAFÉ") programme consolidated and replaced (with the exception of the 4th Daughter Directive) preceding directives with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Ref 6-4) (hereafter referred to as the 'EU Air Quality Framework Directive').	Informed methodology described in **Section 6.4** and results in **Section 6.8**.
Air Quality Standards Regulations	
Directive 2008/50/EC is transcribed into UK legislation by the Air Quality Standards Regulations 2010 (Ref 6-17) which came into force on 11 June 2010. The 2010 Regulations were amended by the Air Quality Standards Regulations 2016 (Ref 6-18), which came into force on 31 December 2016. The limit values defined therein are legally-binding and are considered to apply everywhere (with the exception of the carriageway and central reservation of roads and any locations where the public do not have access). EU limit values were published in these regulations for 7 pollutants, as well as target values for an additional 5 pollutants.	Informed methodology described in **Section 6.4** and results in **Section 6.8**.
UK Air Quality Strategy	
Part IV of the Environment Act (2021) (Ref 6-20) requires the Government to produce a national Air Quality Strategy ("AQS") which contains standards, objectives and measures for improving ambient air quality. Defra's Clean Air Strategy is the current revision of the Strategy (Ref 6-7). The AQS outlines proposals to tackle emissions from a range of sources. This includes providing clear and effective guidance on how Air Quality Management Areas ("AQMAs"), Clean Air Zones ("CAZ") and Smoke Control Areas interrelate and how they can be used by local government to tackle pollution. New legislation will seek to shift the focus towards prevention of exceedances rather than tackling pollution when limits have been surpassed. The AQS sets out air quality objectives that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. Air quality objectives, as defined by the Air Quality Strategy, are generally in line with the EU limit values, although they have different dates for compliance, and a different legal status as follows:	Informed methodology described in **Section 6.4** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
a. EU limit values (as transcribed into UK legislation) are legally binding in the UK. National government compliance at the agglomeration scale is mandatory. b. UK air quality objectives are for the purposes of LAQM and there is no legal obligation for local authorities to achieve them. They do have a responsibility to work towards achieving them. The EU limit values and air quality objectives for the remaining pollutants are displayed in **Table 6-3**.	
UK Clean Air Quality Strategy	
In 2019, the UK adopted the Clean Air Strategy 2019 (Ref 6-7), setting out targets and the policies for how it will tackle all sources of air pollution, complementing three other UK government strategies: the Industrial Strategy, the Clean Growth Strategy and the 25 Year Environment Plan. It sets out the Government's long-term target to reduce people's exposure to $PM_{2.5}$, to 10 µg/m^3 in line with the World Health Organisation's (WHO) current guidelines. It sets out how the Government will reduce $PM_{2.5}$ concentrations across the UK, so that the number of people living in locations above the WHO guideline level of 10 µg/m^3 is reduced by 50% by 2025.	Informed methodology described in **Section 6.4** and results in **Section 6.8**.
Environment Act 2021	
The Environment Act 2021 (Ref 6-20) is the UK's primary piece of environmental legislation post-Brexit for Ref 6-16environmental protection and the delivery of the Government's 25-year environment plan It includes provisions to establish a post-Brexit set of statutory environmental principles and ensure environmental governance through an environmental watchdog, the Office for Environmental Protection ("OEP"). Part IV of the Environment Act (2021) requires the Government to produce a national AQS which contains standards, objectives and measures for improving ambient air quality. The AQS proposes for the Secretary of State to publish a report reviewing the AQS every five years (as a minimum and with yearly updates to Parliament). The Act also requires the Government to set two targets by October 2022: the first on the amount of $PM_{2.5}$ pollutant in the ambient air and a second long-term target set at least 15 years ahead to encourage stakeholder investment. Those Targets are set by the Environmental Improvement Plan (Ref 6-22).	Informed methodology described in **Section 6.4** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
Environmental Improvement Plan 2023	
On the 31 January 2023, the Environmental Improvement Plan (the Plan) (Ref 6-22) was published to build upon the Government's 25 Year Environmental Plan and in accordance with the provisions of the Environment Act 2021. A key target of the Plan is to improve environmental quality, including measures to: *"Cut overall air pollution by tackling the key sources of emissions, including reducing the maximum limits for domestic burning appliances in Smoke Control Areas.* *Tackle specific hotspots by challenging councils to improve air quality more quickly, while supporting them with clear guidance, funding, and tools.* *Reduce ammonia emissions (crucial for sensitive natural habitats) by using incentives in our new farming schemes".* The Plan confirms the legal target to reduce population exposure to $PM_{2.5}$ by 35% in 2040 compared to 2018 levels, with a new interim target to reduce by 22% by the end of January 2028, and a legal target to require a maximum annual mean concentration of 10 micrograms of $PM_{2.5}$ per cubic metre (µg/m^3) by 2040, with a new interim target of 12 µg/m^3 by the end of January 2028.	Informed methodology described in **Section 6.4** and results in **Section 6.8**.
The Environmental Targets (Fine Particulate Matter) Regulations 2023	
On 30 January 2023, regulations were published regarding the new targets for $PM_{2.5}$ concentrations (Ref 6-21) as required by the Environment Act. The regulations set out the following targets: *"The annual mean concentration target is that by the end of 31st December 2040 the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10 µg/m³ ("the target level")* *The population exposure reduction target is that there is at least a 35% reduction in population exposure by the end of 31st December 2040 ("the target date"), as compared with the average population exposure in the three-year period from 1st January 2016 to 31st December 2018 ("the baseline period"), determined in accordance with regulation 8".*	Informed methodology described in **Section 6.4** and results in **Section 6.8**.
National Policy Statement for Ports ("NPSfP")	
Section 5.7 of the NPSfP (Ref 6-13) sets out the Government's policy for ports relating to air quality. It highlights key air quality concerns relating to ports as emissions from vehicles accessing and leaving ports, emissions from ship engines and dust emissions from potentially dust generating cargo. Paragraph 5.13.5 of the NPSfP describes what an air quality chapter of an ES should include:	Informed methodology described in **Section 6.4** and specifically a description of emissions, and how they have informed the impact assessment. Informed the impact results reported in **Section 6.8**,

Legislation/Policy/Guidance	Consideration within the assessment
• *"Any significant air emissions, their mitigation and any residual effects, distinguishing between the construction and operation stages and taking account of any significant emissions from any road traffic generated by the project;* • *The predicted absolute emission levels from the proposed project, after mitigation methods have been applied; and* • *Existing air quality levels and the relative change in air quality from existing levels."* Section 5.8 of the NPSfP sets out policy for ports relating to emissions of dust and odour and the potential harm to amenity. It is acknowledged in the NPSfP that *"some impact on amenity for local communities is likely to be unavoidable. The aim should be to keep impacts to a minimum and at a level that is acceptable".* Paragraph 5.8.5 of the NPSfP describes what an air quality chapter should include with regards to potential emissions of dust and odour: • *"the type, quantity and timing of emissions;* • *aspects of the development which may give rise to emissions;* • *premises or locations that may be affected by the emissions;* • *effects of the emission on identified premises or locations; and* • *measures to be employed in preventing or mitigating the emissions."*	specifically predicted future baseline and future operational pollutant concentrations and impacts. Informed mitigation section described in **Section 6.7** and **Section 6.9**, including measures to reduce emissions during construction and operational phases.
UK Marine Policy Statement ("MPS")	
Section 2.6.2 of the UK MPS (Ref 6-5) sets out the Government's policy for marine environments relating to air quality. In paragraph 2.6.2.1 it is noted that *"The construction, operation and decommissioning phases of projects can involve emissions to air which could lead to adverse impacts on human health, biodiversity, or on the wider environment."*	Informed methodology described in **Section 6.4**.
UK Marine Strategy	
Descriptor 5 as described in the Marine Strategy Part Three (Ref 6-6) refers to the Control of Nitrogen Oxides (NO_x) emissions from ships through the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 (as amended). It states that this measure requires engines installed on a ship to meet the specified NOx emission standard and is primarily designed to improve air quality.	Informed methodology described in **Section 6.4**.

Legislation/Policy/Guidance	Consideration within the assessment
Marine Plan – East Inshore	
The Marine Plan for the UK East Inshore region (Ref 6-30) includes some policies that are relevant to air quality and this assessment. They focus on potential impacts on nature conservation as follows: a. Policy BIO1 Biodiversity – *"Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East marine plans and adjacent areas (marine, terrestrial)"*; b. Policy ECO1 Ecosystem – *"Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation";* c. Policy MPA1 Marine protected areas – *"Any impacts on the overall Marine Protected Area network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network."*	Informed methodology described in **Section 6.4**.
National Planning Policy Framework ("NPPF")	
The revised NPPF (Ref 6-31) sets out the Government's planning policies for England and how these are expected to be applied. The revised NPPF maintains the presumption in favour of sustainable development which should be delivered in accordance with three main objective areas: economic, social and environmental (Paragraph 8). The revised NPPF aims to enable local people and their local authorities to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities. Air quality is considered as an important element of the natural environment. On conserving and enhancing the natural environment, Paragraph 174 states that: *"Planning policies and decisions should contribute to and enhance the natural and local environment by:* *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality …"* Air quality in the UK has been managed through the LAQM regime using national objectives. The effect of a proposed development on the achievement of such policies and plans may be a material consideration by planning authorities when making decisions for	Informed methodology described in **Section 6.4** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
individual planning applications. Paragraph 186 of the NPPF states that: *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*	
Planning Practice Guidance ("PPG")	
Sections of the PPG (Ref 6-12) were updated in November 2019. With regards to air quality, the updated guidance (paragraph 003 Reference ID: 32-003-20191101) states that: *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."* In paragraph 005 (Reference ID: 32-005-20191101) it is stated that: *"Where air quality is a relevant consideration the local planning authority may need to establish:* • *the 'baseline' local air quality, including what would happen to air quality in the absence of the development;* • *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and* • *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality."* The PPG goes on to state that considerations that may be relevant to determining a planning application include whether the development would (Paragraph: 006 Reference ID: 32-006-20191101):	Informed methodology described in **Section 6.4** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
a. Lead to changes in vehicle-related emissions in the immediate vicinity of the proposed development or further afield; b. Introduce new point sources of air pollution; c. Expose people to harmful concentrations of air pollutants; d. Give rise to potentially unacceptable impacts during construction for nearby sensitive locations; and e. Have a potential adverse effect on biodiversity. f. The PPG also suggests that the following items could form part of an air quality assessment suitable for an EIA (Paragraph: 007 Reference ID: 32-007-20191101): g. A description of baseline conditions; h. Consideration of sensitive habitats (including designated sites of importance for biodiversity); i. The assessment methods to be adopted and any requirements for the verification of modelling air quality; j. The basis for assessing impacts and determining the significance of an impact; k. Where relevant, the cumulative or in-combination effects arising from several developments; l. Construction phase impacts; m. Acceptable mitigation measures to reduce or remove adverse effects; and n. Measures that could deliver improved air quality even when legally binding limits for concentrations of major air pollutants are not being breached.	
North East Lincolnshire Local Plan (2013 – 2032)	
The Local Plan was adopted in 2018 and sets out a strategic vision for the county (Ref 6-36). The plan is centered around set challenges for the Local Council and policy which has been implemented to solve them and support local economic sectors. A key challenge highlighted in the Local Plan (paragraph 14.151) is to *"ensure transport contributes to environmental excellence, improved air quality and reduced greenhouse gas emissions"* and aims to enhance the environment in parallel with delivering economic growth. A key weakness identified by the council with regards to the environment is pockets of poor air quality in Grimsby and Immingham. Immingham town itself serves the surrounding rural community. The main challenges in this area concern traffic movements and air quality in relation to proximity to the Port of Immingham.	Informed methodology described in **Section 6.4**, baseline in **Section 6.6** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
A relevant strategic objective outlined in the Local Plan is SO [Strategic Objective] 2: Climate change. Whilst titled *"Climate change"*, this objective also includes managing air quality in the North East Lincolnshire Council area, decreasing the number of active AQMAs, and improving use of sustainable modes of transport. Several policies within the Local Plan are relevant to air quality in the Immingham port area: a. Policy 5: Development boundaries sets out how all proposed developments within the Council must consider noise and air quality, in line with sustainability considerations. b. Policy 31: Renewable and low carbon infrastructure was introduced to maximise renewable energy capacity and developments must consider use of renewable energy along with air quality impacts. c. Policy 36: Promoting sustainable transport aims to reduce congestion and improve environmental quality. This policy highlights priority areas, including the A180 corridor, where sustainable transport measures and highway improvements will be focused.	
North East Lincolnshire Council Transport Plan	
This Plan also highlights air quality in Transport Challenge H (section 1.3), which recognises that emissions of transport account for a large part of the council's total carbon emissions and is a source of poor air quality in Immingham and Grimsby (Ref 6-35).	Informed methodology described in **Section 6.4,** baseline in **Section 6.6** and results in **Section 6.8**.
North Lincolnshire Local Development Framework ("LDF") (2006 to 2026)	
The North Lincolnshire Local Plan has been replaced by the LDF (2006 to 2026). The LDF consists of a Core Strategy (Ref 6-38) which states that a key goal of the Framework is to reduce pollution levels and frame North Lincolnshire local environmental needs within the wider global picture. Most air quality management objectives focus on the AQMA at Scunthorpe. However, a relevant objective to the Project is: a. Spatial Objective 7: Efficient Use and Management of Resources. This aims to support measures to minimise pollution and improve air quality and ensure adequate infrastructure is in place to serve new developments.	Informed methodology described in **Section 6.4,** baseline in **Section 6.6** and results in **Section 6.8**.
North Lincolnshire Local Transport Plan (2011 – 2026)	
The plan details a strategic vision for transport management in the borough (Ref 6-39). Local transport goals include supporting sustainable modes of transport and reducing traffic related CO_2 and NO_2 emissions so as to protect and enhance the natural	Informed methodology described in **Section 6.4,** baseline in **Section 6.6** and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
environment. In the Transport Plan, the A160 at South Killingholme was identified as an area of concern regarding levels of NO_2.	
Guidance on the assessment of dust from demolition and construction	
Published by the IAQM (Ref 6-23), this guidance describes a qualitative methodology for the assessment of potential construction phase impacts from construction dust, traffic, and non-road mobile machinery.	Informed methodology described in **Section 6.4** and **Appendix 6.A [TR030008/APP/6.4]**, and results in **Section 6.8**.
Land-Use Planning & Development Control: Planning for Air Quality	
Published by the IAQM (Ref 6-32), this guidance describes a methodology to assist with screening the level of detail required of an air quality assessment, based on several variables including the magnitude of traffic impact, and a means to describe air quality impacts on human health and the determination of whether they are significant.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.
DMRB – Sustainability & Environment Appraisal: LA 105 Air quality	
Published by National Highways (Ref 6-33), this guidance provides a methodology for the assessment of air quality impacts associated with motorway and all-purpose trunk road projects. It has been referred to in this assessment for the consideration of potential impacts on receptors adjacent to the Strategic Road Network.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.
Local Air Quality Management Technical Guidance 2022 (LAQM TG(22))	
Published by Defra (Ref 6-8), LAQM TG(22) is guidance intended to assist local authorities with their annual reporting of local air quality within their administrative areas. The guidance includes various best practice methods and tools that have been used to inform the air quality assessment described in this chapter.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.
Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations (NEA001)	
Guidance on how Natural England advises competent authorities and others on the assessment of plans and projects (as required by the 'Habitats Regulations') likely to generate road traffic emissions to air which are capable of affecting European Sites.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.
A guide to the assessment of air quality impacts on designated nature conservation sites	
Published by the IAQM (Ref 6-24), this guidance describes a methodology to assist with assessment of air quality impacts on nature conservation.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.

Legislation/Policy/Guidance	Consideration within the assessment
Air emissions risk assessment for your environmental permit	
Published by the Environment Agency (Ref 6-14), this guidance provides a methodology for assessment of point source emissions impacts on human health and nature conservations sites.	Informed methodology described in **Section 6.4** and **Appendix 6.B [TR030008/APP/6.4]**, and results in **Section 6.8**.

6.3.2 The EU limit values, UK air quality objectives and relevant Critical Levels and Loads for the pollutants of concern are displayed in **Table 6-3**. Limits and objectives are expressed in one of two ways: as annual mean concentrations which are not to be exceeded without exception, due to their chronic effects; or as shorter term (24 hour or one hour) mean concentrations for which only a specified number of exceedances are allowed within a specified time frame, due to their acute effects.

6.3.3 An air quality objective for NO_X of 30 µg/m^3 and SO_2 of 20 µg/m^3 are set for the protection of vegetation (referred to as Critical Levels). In addition to these, a Critical Level for NH_3 has been defined by the Environment Agency and Critical Loads for nitrogen deposition have been determined by the UNECE Convention on Long Range Transboundary Air Pollution. These represent (according to current knowledge) the exposure below which there should be no significant harmful effects on sensitive elements of those habitats. Critical loads are set for different types of habitat based on their respective sensitivity to nutrient nitrogen and have been obtained for the designated sites with the potential to be affected by the Project.

Table 6-3: Air quality objectives, EU limit values and Environmental Assessment Levels

Pollutant	Averaging Period	Concentration	Maximum Permitted Exceedances	Target Date (AQO)	Target Data (EULV)
AQOs/EULVs for the Protection of Human Health					
Nitrogen Dioxide (NO_2)	Annual mean	40µg/m^3	None	31 Dec 2005	1 Jan 2010
	1 hour mean	200µg/m^3	18 times per year	31 Dec 2005	1 Jan 2010
Particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10})	Annual mean	40µg/m^3	None	31 Dec 2004	1 Jan 2005
	24 hour mean	50µg/m^3	35 times per year	31 Dec 2004	1 Jan 2005

Pollutant	Averaging Period	Concentration	Maximum Permitted Exceedances	Target Date (AQO)	Target Data (EULV)
Particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$)	Annual mean	20 µg/m^3	None	1 Jan 2020	1 Jan 2010
Sulphur Dioxide (SO_2)	24 hour mean	125 µg/m^3	3 times per year	31 Dec 2004	1 Jan 2005
	1 hour mean	350 µg/m^3	24 times per year	31 Dec 2004	1 Jan 2005
AQOs/EULVs for the Protection of Vegetation and Ecosystems					
Nitrogen oxides (NO_X)	Annual mean	30 µg/m^3	None	31 Dec 2000	19 Jul 2001
Sulphur dioxide (SO_2)	Annual mean	20 µg/m^3	None	31 Dec 2000	19 Jul 2001
Environmental Assessment Levels for the Protection of Vegetation and Ecosystems					
Ammonia (NH_3)	Annual mean	3 µg/m$^{3(1)}$	None	N/A	N/A
Nutrient nitrogen deposition	Annual mean	Salt marsh: 10-20 kg N/ha/yr Woodland: 10-20 kg N/ha/yr Grassland: 10-20 kg N/ha/yr	None	N/A	N/A
[1] 1 µg/m^3 where lichens or bryophytes (including mosses, liverworts and hornwarts) are present, 3 µg/m^3 where they are not present. Bryophytes are not considered present at the habitats considered in this assessment.					

6.4 Assessment Methodology

6.4.1 The assessment of air quality impacts has been undertaken with reference to the industry standard guidance documents listed in **Table 6-3**. In line with **Chapter 5: EIA Process [TR030008/APP/6.2]**, the assessment of impacts assumes that embedded and standard mitigation (see **Section 6.7**) is already in place. Embedded and standard mitigation includes all control measures described in the **Outline Construction Environmental Management Plan ("CEMP") [TR030008/APP/6.5]**. As such, no unmitigated scenario is assessed because such a scenario will never occur.

6.4.2 This approach does deviate to some extent, from the IAQM guidance relating to the assessment of construction phase dust emissions (Ref 6-23). The methodology set out in that guidance requires the assessment of impacts without mitigation to determine the level of mitigation required to offset the risk of dust impacts occurring. For the assessment of construction dust emissions, the assessment has been undertaken in line with that guidance, to identify the level of mitigation required to be included in the **Outline CEMP [TR030008/APP/6.5]** but is reported in the order described by **Chapter 5: EIA Process [TR030008/APP/6.2]**, to maintain consistency with other chapters.

6.4.3 The assessment considers the following scenarios:

a. Existing baseline (2022) – for road traffic emissions model verification.

b. Future baseline (2026) – to represent the year of peak construction without the Project under construction.

c. Future construction (2026) – to represent the year of peak construction with the Project under construction.

d. Future baseline (2028) – to represent the year of opening without the Project in operation.

e. Future operational (2028) – to represent the year of opening with the Project in operation

6.4.4 It has been assumed for the purpose of this assessment, that the Project will be fully operational in the year of opening (2028). In reality, not all of the Project is likely to be operational until 2036. The assumption that all Project sources are operational in 2028 is precautionary, as it assumes all those sources will combine with the baseline conditions of 2028. Due to the anticipated year-on-year improvement in background air quality and the year-on-year evolution of emissions technology, baseline air quality conditions are likely to better in 2036. As such, the total pollutant concentrations reported for 2028, based on full operation, are precautionary.

Construction Phase

Construction Dust Emissions

6.4.5 The construction dust assessment follows the qualitative method of assessment set out in IAQM guidance (Ref 6-23). According to that guidance, the main air quality impacts that may arise during demolition and construction activities are:

a. Dust deposition, resulting in the soiling of surfaces.

b. Visible dust plumes, which are evidence of dust emissions.

c. Elevated PM_{10} and $PM_{2.5}$ concentrations resultant of dust generating activities on site (with majority of fine particulates generated from construction phase activities having an aerodynamic diameter of greater than 25µm).

d. An increase in concentration of airborne particles and NO_2 due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the site.

6.4.6 Activities on construction sites are classified into four types to reflect their different potential impacts:

a. Demolition (not of relevance to the Project).

b. Earthworks.

c. Construction (erection of buildings and structures).

d. Track-out (the deposition of material onto the public road network by construction vehicles leaving site).

6.4.7 The following steps, as defined by the IAQM, were followed as part of the construction dust assessment:

a. Step 1: Screen the need for a detailed assessment. Human and ecological receptors were identified and distance to the Project and construction routes were determined.

b. Step 2: Assess the risk of dust impacts arising. The potential risk of dust impacts occurring for each activity was determined, based on the magnitude of the potential dust emissions and the sensitivity of the area.

c. Step 3: Identify the need for site-specific mitigation. Based on the risk of impacts occurring, site specific mitigation measures were determined.

d. Step 4: Define impacts and their significance. The significance of the potential residual dust impacts (taking mitigation into account) for each activity was determined.

6.4.8 The IAQM construction dust methodology used to inform this assessment is provided in more detail in **Appendix 6.A [TR030008/APP/6.4]**.

Construction Site Plant and Non-Road Mobile Machinery Emissions

6.4.9 Emissions from construction-related Non-Road Mobile Machinery ("NRMM") and site plant will have the potential to increase NO_2, PM_{10} and $PM_{2.5}$ concentrations at locations close to working areas of the site.

6.4.10 IAQM guidance (Ref 6-23) states that:

> *"Experience of assessing the exhaust emissions from on-site plant (NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed."*

6.4.11 The assessment of potential emissions from NRMM and site plant is, therefore, qualitative in nature and focuses on the justification as to why impacts from this source can be mitigated to ensure any effect is not significant.

Construction Vessel Emissions

6.4.12 Construction vessel emissions have the potential to impact on sensitive receptors by increasing exposure to the pollutants most commonly associated with combustion emissions, namely NO_X, which is a precursor for NO_2 and nitrogen deposition, PM_{10} and $PM_{2.5}$. SO_2 (and PM) emissions will be limited due to use of low-sulphur content fuel.

6.4.13 Construction phase vessel emissions have been considered in a qualitative manner in this assessment. The risk of this source contributing to a significant effect is determined by review of construction phase vessel emissions, their duration and frequency, and the proximity of those emissions to the nearest air quality sensitive receptors.

Construction Road Traffic Emissions

6.4.14 The assessment of construction traffic emissions focuses on the primary pollutants of concern with regards to vehicle exhaust emissions – NO_X, the precursor for NO_2 and nitrogen deposition, PM_{10} and $PM_{2.5}$.

6.4.15 Construction phase traffic emissions can be considered in a qualitative manner or quantitative manner, subject to the traffic impact expected and how that compares to relevant screening criteria set out in industry standard guidance (Ref 6-32, Ref 6-33). Where traffic impacts exceed the screening criteria, a detailed quantitative assessment methodology is taken forward, the approach to which is described in **Appendix 6.B [TR030008/APP/6.4]**.

6.4.16 Traffic data has been provided which includes daily average two-way Light Duty Vehicle ("LDV") (vehicles <3.5 tonnes) movements and Heavy Duty Vehicle ("HDV") (vehicles >3.5 tonnes) movements on the local road network and the nearest sections of the SRN.

6.4.17 Daily average flows on the local road network have been screened against criteria published in IAQM and EPUK guidance (Ref 6-32). The guidance suggests that a detailed assessment of local air quality is likely to be required where:

a. A road link not situated within or adjacent to an AQMA experiences a:
   i. change in annual average daily two-way LDV flow of 500 or more.
   ii. change in annual average daily two-way HDV flow of 100 or more.
b. A road link that is situated within or adjacent to an AQMA experiences a:
   i. change in annual average daily two-way LDV flow of 100 or more.
   ii. change in annual average daily two-way HDV flow of 25 or more.

6.4.18 Daily average flows on the SRN have been screened against criteria published in National Highways guidance (Ref 6-33). The guidance suggests that a detailed assessment of local air quality is required where:

a. Annual average daily traffic ("AADT") flow changes by 1000 or more two-way movements.
b. HDV AADT changes by 200 or more two-way movements.

6.4.19 Where a road link exceeds the criteria above and where there are air quality sensitive receptors within 200m of that link, detailed modelling of road traffic emissions has been undertaken, following the approach set out in **Appendix 6.B [TR030008/APP/6.4]**.

6.4.20 The National Highways screening criteria is also referred to in Natural England guidance (Ref 6-33) in their step by step approach to determining whether the road traffic impacts of a scheme or project could have a significant effect on a nature conservations site covered by the Habitat Regulations.

Operational Phase

Operational Road Traffic Emissions

6.4.21 The approach undertaken for construction phase road traffic emissions has also been undertaken for operational phase road traffic emissions. Where a road link exceeds the criteria set out in **Paragraphs 6.4.17** and **6.4.18**, where there are air quality sensitive receptors within 200m of that link, detailed modelling of road traffic emissions has been undertaken, following the approach set out in **Appendix 6.B [TR030008/APP/6.4]**.

Operational Odour emissions

6.4.22 A qualitative odour assessment has been undertaken with reference to IAQM odour guidance (Ref 6-25).

6.4.23 Odours are highly subjective. The perception of odours, whether they are pleasant or offensive, and to what extent is partly determined through the life experiences of the individual. It is, however, generally accepted that the odour associated with NH_3 is offensive.

6.4.24 Before an adverse effect (such as harm to amenity) can occur, there must be odour exposure. For odour exposure to occur all three links in the source-pathway-receptor chain must be present:

a. An emission source - a means for the odour to get into the atmosphere.

b. A pathway - for the odour to travel through the air to locations offsite, noting that:

   i. Anything that increases dilution and dispersion of an odorous pollutant plume as it travels from source to receptor will reduce the concentration at the receptor, and hence reduce exposure.

   ii. Increasing the length of the pathway (e.g. by releasing the emissions from a high flare stack or moving odour sources as far away from receptors as possible) will, all other things being equal, increase the dilution and dispersion.

c. The presence of receptors (such as residential properties or places where people would expect a certain level of amenity) that could experience an adverse effect, noting that people vary in their sensitivities to odour, determined by the level of amenity associated with the land use and the typical duration of exposure.

6.4.25 The IAQM guidance (Ref 6-25) includes a description of methods by which odour effects can be determined at the pre-planning stage. It states that in order to determine the impact of odour emissions, the following elements need to be determined:

a. Description of baseline odour conditions.

b. Description of the location of receptors and their relative sensitivities to odour effects.

c. Details of potential odour sources.

d. Description of control/mitigation measures incorporated into the scheme.

e. Prediction of the likely odour effects at relevant sensitive receptors, taking into account:

   i. The likely magnitude of odour emissions.

   ii. The likely meteorological characteristics at the site.

   iii. The dispersion and dilution afforded by the pathway to receptors and the resulting magnitude of odour that could result.

   iv. The sensitivity of the receptors.

   v. The potential cumulative odour effects.

f. Appropriate additional mitigation recommended where necessary.

g. Residual odour effects and the determination of impact significance.

Operational Site and Vessel Emissions

6.4.26 Operational vessel emissions have the potential to impact on sensitive receptors by increasing exposure to the pollutants most commonly associated with combustion emissions, namely NO_X, a precursor for NO_2 and nitrogen deposition and fine particulate matter. SO_2 and PM emissions will be limited by MARPOL Regulation 14 (Ref 6-27) and the use of low-sulphur content fuel and/or other SO_2 and PM emissions reduction technologies.

6.4.27 The assessment of operational site and vessel emissions follows a hybrid approach, based on the perceived risk of sources contributing to a significant effect on air quality. Site emissions consist of those from a number of onshore hydrogen production units and flares, and offshore vessel combustion plant emissions. A quantitative assessment of those sources that are considered to represent a risk of contributing to a significant effect has been undertaken and is described in **Appendix 6.B [TR030008/APP/6.4]**.

6.4.28 The onshore hydrogen production units will be fuelled initially by natural gas. The main pollutant of concern from this is the NO_X emissions from the combustion of the gas. The hydrogen production units will have Selective Catalytic Reduction ("SCR") technology installed to reduce the amount of NO_X released. The presence of SCR technology will also mean that another pollutant of concern will be NH_3 emissions associated with the SCR process. NO_X and NH_3 at elevated concentrations are harmful to nature conservations sites and, when NO_X is converted to NO_2 following release into the ambient air, also harmful to human

health. NO_2 and NH_3 also contribute to nitrogen deposition, which is harmful to nature conservation sites. It is considered that emissions from hydrogen production units have the potential to contribute to a significant effect on air quality and these sources are included in the detailed assessment.

6.4.29 Flares will also be a source of combustion emissions. The flares will operate for most of the time on pilot mode. They will only operate on flare mode in the event of an emergency or during plant start-up, to burn off the release of any uncontrolled NH_3. Such an event is not expected to occur for more than a few hours per year.

6.4.30 Exhaust emissions from vessels during operation have the potential to impact on air quality, particularly when they are in dock. At such time, the vessel emissions source is static and, given the anticipated frequency of vessels in dock, operational for approximately 80% of the year. This means that docked vessel emissions will impact on the same locations consistently throughout the year, subject to meteorological conditions. Docked vessel emission impacts on local air quality have been quantified in this assessment.

6.4.31 Pollutants of concern vary depending on the fuel type of the vessel engine, such as Liquified Natural Gas ("LNG") and Marine Gas Oil ("MGO") but will include NO_X (NO and NO_2).

6.4.32 Vessels using the Project in the operational phase will need to comply with relevant International Convention for the Prevention of Pollution from Ships ("MARPOL") NO_X and SO_2 emission standards (Ref 6-26 and Ref 6-27), noting that approach to and from the Project is within the North Sea Emissions Control Area ("ECA").

6.4.33 MARPOL Regulation 13 (Ref 6-26) requires that vessel engines comply with tiered NO_X emissions standard based on the age of a vessel's engines. For vessel engine plant installed before 1 January 2021 or new vessels constructed before that same date, NO_X emissions need to be limited to $44n^{-0.23}$ g/kWh (MARPOL Regulation 13 Tier II), where n is the engine's rated speed as Revolutions per Minute ("RPM"). For vessel engine plant or new vessels constructed on or after that date, NO_X emissions will need to be limited to $9n^{-0.2}$ g/kWh (MARPOL Regulation 13 Tier III). It is likely that vessel engines will require SCR technology to meet the Tier III NO_X standard, the use of which will induce some NH_3 slip. Marine vessel NH_3 slip is typically below 10ppm (Ref 6-15), subject to the efficiency of the SCR system.

6.4.34 MARPOL Regulation 14 (Ref 6-27) is not tiered and applies to all vessels operating within an ECA. To reduce emissions of SO_2 and fine particulates (PM_{10}), vessel engines must operate using MGO with a sulphur content of no more than 0.10 %m/m when travelling through the North Sea ECA, or by means of technological intervention, such as an SO_2 scrubber (subject to approvals with the relevant administration). SO_2 and PM emissions from vessels are therefore likely to be negligible and are not considered further in this assessment.

6.4.35 The detailed assessment methodology followed to quantify the contribution of vessel emissions to impacts and total concentrations of the pollutants of concern is set out in **Appendix 6.B [TR030008/APP/6.4]**.

Air Quality Sensitive Receptors

6.4.36 The air quality receptors selected for this assessment are those that are considered sensitive to air quality effects and most likely to experience worst-case impacts from the impact pathways considered, because of the Project's construction and operation. Each selected receptor can be considered representative of other sensitive locations in their vicinity.

6.4.37 Receptor selection therefore takes account of the study area of each impact pathway (see **Section 6.5**) and the location of sensitive receptors relative to the Project's emission sources. The receptors considered in the assessment are described in **Appendix 6.A** and **Appendix 6.B [TR030008/APP/6.4]** and shown in **Figure 6.1 [TR030008/APP/6.3]**.

6.4.38 With regards to construction phase emissions, there are a number of high sensitivity amenity and human health sensitive receptors within the 250 m of the construction Site Boundary criteria in the IAQM guidance (Ref 6-23). These include the residential dwellings off Queens Road, immediately adjacent to the West Site. There is also lower sensitivity commercial and industrial land use adjacent to both the East Site and the West Site. There are also a number of nature conservation receptors within the 50 m of the construction Site Boundary criteria set out in the IAQM guidance (Ref 6-23), including the high sensitivity Humber Estuary Special Area of Conservation ("SAC")/Special Protection Area ("SPA"), which is immediately adjacent to the East Site. Although the mudflat habitat closest to the Site is not considered as sensitive to construction phase impacts as more distant SAC habitat, such as saltmarsh.

6.4.39 Receptors sensitive to impacts from road traffic and point source emissions include the residential properties and nature conservation sites described above, but also more distant receptors, including human health sensitive receptors in the East Riding of Yorkshire Council ("ERoY") area and Grimsby, and the saltmarsh habitat along the northern and southern shore of the Humber Estuary. It is noted that the residential receptors considered in the construction phase assessment on Queens Road will not be present in the operational scenario as explained in **Paragraph 6.4.64**.

6.4.40 Receptor sensitivity to combustion emissions is determined in line with relevant guidance (Ref 6-23, Ref 6-24, Ref 6-25, Ref 6-32). With regards to impacts of the pollutants set out in the Air Quality Standards Regulations (Ref 6-17, Ref 6-18), the sensitivity of receptors was considered in the setting of those Standards. As such, a high level of sensitivity is applied to all receptors subject to the duration of their exposure (determined by land use) relative to the exposure period set by the Standards.

Determination of Significance

Construction Phase and Operational Phase Amenity Impacts

6.4.41 For amenity effects from coarser dust (>PM_{10}) and odour, the aim of the IAQM guidance methods is to bring forward a scheme, including mitigation measures where necessary, that would control impacts so that they give rise to negligible or minor effects (at worst) at the closest sensitive receptors. Measures that reduce construction dust emissions will also reduce emissions of finer particles (PM_{10}).

6.4.42 Determination of whether an effect is likely to be significant or not is based on professional judgement (based on experience of similar projects), taking account of whether effects are permanent or temporary, direct or indirect, constant or intermittent. Also, for construction dust, whether any secondary effects are caused (in this instance, secondary effects refer to dust that is generated and deposited (primary impact) and then re-suspended and deposited again by further activity).

6.4.43 The classification of dust soiling (amenity) and health effects on receptors exposed to impacts has been assessed using the relationship between the magnitude of impact identified, in combination with receptor sensitivity and other related factors where appropriate (as described in the IAQM guidance (Ref 6-23)), which results in a classification of effects as defined in **Table 6-4**.

6.4.44 The impacts associated with the operational phase odour emissions have been qualitatively assessed following the approach set out in the IAQM guidance on the Assessment of Odour for Planning (Ref 6-25).

Table 6-4: Definition of Significance for Fugitive Dust, PM_{10} and Odour Effects

Effect	Change in Dust Deposition Rate and Short-term PM_{10} Concentrations	Change in Odour Conditions	Significance
Major	Impact is likely to be intolerable for any more than a very brief period of time and is very likely to cause complaints from local people.		A significant effect that is likely to be a material consideration in its own right.
	Increase in PM_{10} concentrations at a location where concentrations are already elevated and to the extent that the short term PM_{10} air quality objective is likely to be exceeded. Deposition impact likely to harm habitat within a designated nature conservation area of international importance.		

Effect	Change in Dust Deposition Rate and Short-term PM_{10} Concentrations	Change in Odour Conditions	Significance
Moderate	Impact is likely to cause annoyance and might cause complaints, but may be tolerated if short-term and prior warning and explanation has been given.		A significant effect that may be a material consideration in combination with other significant effects but is unlikely to be a material consideration in its own right.
	Increase in PM_{10} concentrations at a location where concentrations are already elevated and to the extent that the short term PM_{10} air quality objective is at risk of being exceeded. Deposition impact likely to harm habitat within a designated nature conservation area of national importance.		
Minor	Impact may be perceptible, but of a magnitude or frequency that is unlikely to cause annoyance to a reasonable person or to cause complaints.		An effect that is not significant but that may be of local concern.
	Limited increase in PM_{10} concentrations. Deposition impact likely to harm habitat within a designated nature conservation area of local importance.		
Negligible	Impact is unlikely to be noticed by and/or have an effect on sensitive receptors.		An effect that is not significant.
	Negligible increase in PM_{10} concentrations and deposition.		

Construction Phase and Operational Phase Combustion Emissions

6.4.45 For local air quality impacts from combustion emissions associated with construction phase and operational phase road traffic movements, vessel movements and energy and process plant, the significance of local air quality effects is determined in line with IAQM/EPUK guidance (Ref 6-32). This approach does not define a graduating scale of human health receptor sensitivity. Instead, human health receptors are considered either sensitive or not, depending on the period of time for which they are exposed to emissions. The absolute magnitude of change in pollutant concentrations between the baseline and assessment scenarios, relative to the air quality objective value, is described and this is used to consider the risk of those objectives being exceeded.

6.4.46 For a change in annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, of a given magnitude, the IAQM and EPUK guidance provides recommendations for describing the effects of such impacts at individual receptors. These are set out in **Table 6-5**.

Table 6-5: Impact Descriptors at Individual Receptors - Annual Mean NO_2, PM_{10} and $PM_{2.5}$

Annual Mean Concentrations at Receptor in Assessment Year (% of air quality objective)	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)				
	<1 %[1]	1 %[2]	2-5 %[3]	6-10 %[4]	> 10 %[5]
≤75 %	Negligible	Negligible	Negligible	Slight	Moderate
76 % – 94 %	Negligible	Negligible	Slight	Moderate	Moderate
95 % – 102 %	Slight	Slight	Moderate	Moderate	Substantial
103 % – 109 %	Moderate	Moderate	Moderate	Substantial	Substantial
≥110 %	Moderate	Moderate	Substantial	Substantial	Substantial
[1] Imperceptible; [2] Very low; [3] Low; [4] Medium; [5] Large					

6.4.47 The IAQM/EPUK guidance states that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. It also states that it is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the objective value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the objective value, rather than being exactly equal to it.

6.4.48 A change in predicted long-term (annual mean) concentrations of less than 0.5% of an air quality objective is considered to be 'Imperceptible'. An impact that is 'Negligible', given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

6.4.49 The guidance suggests the potential for 'Low' air quality impacts arises as a result of changes in pollutant concentrations between 2% and 5% of relevant air quality objective. For example, for annual mean NO_2 and PM_{10} concentrations, this relates to changes in concentrations ranging from 0.6 – 2.1 µg/m^3. In practice, changes in concentration at the lower end of this magnitude band are likely to be very difficult to distinguish from the inter-annual effects of varying meteorological conditions and are therefore not considered likely to be capable of having a direct effect on local air quality that could be considered to be significant.

6.4.50 Changes in concentration of more than 5% are considered to be of a magnitude which is far more likely to be discernible above the normal variation in baseline conditions and, as such, carry additional weight within the overall evaluation of significance for air quality. 'Moderate' impacts do not necessarily constitute a significant effect, where they do not contribute to an exceedance or risk of an exceedance of an air quality objective, particularly where such impacts relate to a small minority of receptors when the majority experience lesser impacts. A 'Substantial' impact will almost certainly constitute a significant effect that will require additional mitigation to address.

6.4.51 The IAQM and EPUK guidance also provide thresholds for determining whether short-term (one-hour mean and 24-hour mean) impacts on human health sensitive receptors have the potential to cause a significant effect or not. The guidance indicates that severity of peak short-term concentrations can be described without the need to reference background concentrations as the source contribution is used to measure impact, not the overall short-term concentration at the receptor. The guidance suggests the following criteria to determine the impact of peak short-term source contributions:

a. Source contributions ≤10 % of the air quality objective represents an Imperceptible impact that is 'Negligible'.

b. Source contributions between 11-20 % of the air quality objective is Small in magnitude, representing a 'Slight' impact.

c. Source contributions between 21-50 % of the air quality objective is Medium in magnitude, representing a 'Moderate' impact.

d. Source contributions ≥51 % of the air quality objective is Large in magnitude, representing a 'Substantial' impact.

6.4.52 In addition to the short-term criteria provided by the IAQM/EPUK, the magnitude of the change in the predicted number of exceedances of the short-term 24-hour PM_{10} objective can be directly derived from the predicted annual average PM_{10} value using the relationship defined in LAQM.TG (22) (Ref 6-8). An exceedance of the short-term PM_{10} air quality objective is unlikely where annual mean PM_{10} concentrations are less than 32 µg/m^3. Research projects completed on behalf of Defra and the Devolved Administrations (Ref 6-1 and Ref 6-29) have concluded that the short-term 1-hour NO_2 objective is unlikely to be exceeded where annual mean concentrations are predicted to be less than 60 µg/m^3.

6.4.53 For impacts at nature conservation receptors, whether the effect is significant or not is determined by a competent expert in ecology and is described in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. To inform this judgement, National Highways guidance (Ref 6-33) and Environment Agency guidance (Ref 6-14) both state that impacts may be considered insignificant ('not significant') where the impact of a scheme or project alone is less than 1% of the long-term air quality objective or environmental assessment level for the nature conservation site. Natural England guidance (Ref 6-34) also refers to 1% as a screening threshold.

6.4.54 For assessments undertaken based on National Highways guidance (Ref 6-33), it is common practice for the contribution of cumulative emissions sources to be accounted for in both the future baseline (Do-Minimum) scenario and the operational (Do-Something) scenario. With such an approach, the effect of a scheme is determined by consideration of the impact of the scheme alone along with total operational (Do-Something) concentrations and deposition rates that include the contribution of emissions from cumulative sources. Natural England guidance (Ref 6-34) applies the 1% threshold to both a scheme or project alone and the scheme or project in combination with other committed and reasonably foreseeable schemes and projects.

6.4.55 Where the long-term impact at a nature conservation receptor exceeds these criteria, it may also be considered insignificant ('not significant') where the long-term total concentration or deposition rate remains below the relevant environmental assessment level for the nature conservation site.

Limitations and Assumptions

6.4.56 The air quality assessment has been informed by construction phase and operational traffic data used to inform the traffic and transport assessment and therefore is subject to the relevant limitations, assumptions and uncertainties described in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.

6.4.57 The air quality assessment has been informed by onsite emissions source characteristics and data provided by the Project design team, including the location, height and internal diameter of flare stack emission points and vents, and the temperature, rate, and mass by pollutant of emissions released. Where there remains intended flexibility in design, assumptions made have been precautionary where practical. For example, where there is a possible range of flare stack heights from which emissions may be released, the lowest of the possible heights has been assumed, as set out in requirement 4(4) of the **draft DCO [TR030008/APP/2.1]**. This is because a lower release height will result in higher ground level contributions.

6.4.58 There is also flexibility in the final location of the flare stacks on the West Site, within the defined Work Areas, and the internal diameter of all flare stacks proposed. For the assessment reported in this chapter, flare stack locations and the internal diameter of stacks have been modelled at their most likely location and diameter. The internal diameter of the flare stacks is modelled on a reasonable worst case basis, given that any material change to that modelled would affect the structural integrity of stacks and their viability to release the volume of gas required (such that an Environmental Permit would not be granted for the resulting design). There is flexibility as to the final location of the stacks within the West Site, which must be within the defined areas shown on the **Works Plans [TR030008/APP/4.1]** as applicable for the relevant works set out in Schedule 1 of the **draft DCO [TR030008/APP/2.1]**. For the assessment reported in this chapter, flare stacks have been modelled at a certain location within the relevant area shown on the **Works Plans [TR030008/APP/2.1]**, but the construction of the flare stacks in a different location within those areas would not affect the conclusions of this assessment given the distance between those potential locations and the nearest receptors.

6.4.59 Assumptions made to inform the modelling of onsite plant emissions are as follows:

a. Combustion and process emissions associated with the landside hydrogen production units will be operational up to 8760 hours per year.

b. Hydrogen plant will be fitted with Selective Catalytic Reduction technology to reduce emissions of NO_X. It is anticipated that this will cause NH_3 slip and a reasonable worst case of 5ppm has been considered.

6.4.60 The air quality assessment includes the assessment of vessel emissions. At this stage, the actual vessels that will call at the facility are unknown. In the absence of this information, a number of assumptions have been made to inform the modelling of vessel emissions. The assessment is based on the following key assumptions:

a. Two hundred and ninety-two vessel calls to the facility each year, which equates to 0.8 vessel calls as a daily average (this is considered to be a theoretical maximum, or worst case)

b. There will be a single vessel docked at the facility at any one time for 7,008 hours (80%) of the year, based on 292 vessel calls assumed per year.

c. When in dock, vessel energy demand will be met by marine auxiliary engines based on a peak demand of around 8MW, to load and discharge cargo;

d. All vessels calling at the facility will have this same energy demand when in dock, irrespective of size.

e. The Wärtsilä 14V31 (8,260 kW^e) marine auxiliary engine has been assumed to be representative of the engines required to meet this energy demand.

f. The auxiliary engine will operate at full load for every hour a vessel is in dock.

g. The Humber Estuary is part of the North Sea ECA for SO_X and PM_{10}. The assumed implication of the ECA for SO_X and PM_{10} is that vessel emissions of SO_2 and PM_{10} will be negligible, either due to ultra-low sulphur fuel or the operation of a scrubber, following MARPOL Regulation 14.

h. The Humber Estuary is now also an ECA for NO_X. The implication of the ECA for NO_X is that vessels with engines installed prior to 2021 have to comply with the MARPOL Regulation 13 Tier II NO_X emissions standard. Engines installed on or after 1 January 2021 have to comply with the Regulation 13 Tier III emissions standard.

i. Vessels will need to use SCR technology to meet the NO_X Regulation 13 Tier III emissions standard. NH_3 slip from vessel engine SCR use is reported to range from 2ppm to 10ppm. For the purpose of this assessment an NH_3 slip of 10ppm has been assumed from vessel engine emissions.

6.4.61 Combustion emissions associated with flares will be operational on pilot mode for 8760 hours per year. The controlled flaring of NH_3 emissions will only occur in the event of an emergency, or when plant requires start-up.

6.4.62 Meteorological data used in the air quality assessment has been sourced from the nearest and most representative meteorological monitoring site, Humberside Airport, which is approximately 13km southwest of the Site. This data is considered the most representative data available close to the Site. Due to the inter-annual variation in meteorological conditions, five years of data have been used in the modelling of point source emissions to account for that variability, in accordance with Environment Agency guidance.

6.4.63 Defra background data (Ref 6-9) and APIS background data (Ref 6-2) has been used to represent background pollutant concentration data in the study area. These background concentrations have not had any sources removed and are therefore considered to include emissions associated with the existing neighbours of the Site, including nearby industry and the Port of Immingham. Such an approach is considered proportionate and robust, and is in line with industry standard guidance (Ref 6-8, Ref 6-33 and Ref 6-34).

6.4.64 There are a number of residential and mixed residential/commercial properties within the Site on Queens Road. The residential use of these properties is considered incompatible with the operation of the hydrogen production facility on the West Site (and an impediment to the grant of the necessary hazardous substances consent). Discussions are ongoing with the owners and occupiers with a view to negotiating the acquisition of these residential properties by agreement. Compulsory acquisition powers for these properties are also sought through the **draft DCO [TR030008/APP/2.1]**. It is intended that, following the acquisition of the properties, the permanent cessation of their residential use will be secured through the **draft DCO [TR030008/APP/2.1]**. The residential use of these properties does not therefore form part of the operational assessment.

6.5 Study Area

6.5.1 The study area is the area over which potentially significant direct and indirect effects of the Project may occur during its construction and operation (decommissioning having been scoped out of the assessment). Air quality impacts will impact on receptors with the administrative areas of NELC, NLC and ERoY. The study area described below is illustrated on **Figure 6.1 [TR030008/APP/6.3]**.

6.5.2 The Project will be developed across several parcels of land on and in close proximity to the Port of Immingham, which is an existing and well-established port with a number of existing sources of emissions to air. Onsite emissions associated with the construction and operation of the Project will form a small proportion of the overall emissions associated with the Port of Immingham.

6.5.3 The study area for potential construction impacts from dust and particulate matter (particles with an aerodynamic diameter of less than 10 micrometres (PM_{10})) has been determined with reference to IAQM guidance (Ref 6-23). They are only likely to occur at locations where there are human health or amenity sensitive receptors within 250 m of the Site Boundary (taken to represent the construction site boundary in this assessment) and/or 50 m of a public road used by construction vehicles that is within 250 m of a site access point, and where there are sensitive ecological receptors within 50 m of the Site Boundary and/or 50 m

of a public road used by construction vehicles that is within 250m of a site access point.

6.5.4 Potential road traffic emissions impacts during construction and operation are only likely to occur where there are sensitive human and/or ecologically sensitive receptors within 200m of an 'affected' road link (Ref 6-33). An 'affected' road link is defined by the following criteria:

a. Any urban or rural road link not situated within or adjacent to an AQMA that will experience a change in two-way traffic flow of 500 or more annual average daily LDV (vehicles <3.5 tonnes) and/or 100 or more annual average daily HDV (all vehicles >3.5 tonnes), as defined within EPUK and IAQM guidance (Ref 6-32).

b. Any urban or rural road link that is situated within or adjacent to an AQMA that will experience a change in two-way traffic flow of 100 or more annual average daily LDVs and/or 25 or more annual average daily HDVs, as defined within EPUK and IAQM guidance (Ref 6-32).

c. Any road link that forms part of the SRN that will experience a change in two-way traffic flow of 1000 or more AADT and/or 200 or more annual average daily HDVs, as defined within National Highways guidance LA105 (Ref 6-33).

6.5.5 The study area for onsite point source emissions and vessels at berth during operation is determined with reference to Environment Agency permitting guidance (Ref 6-14), which includes worst-case human health and nature conservation impacts within 10km of the emissions sources.

6.5.6 Vessel emissions impacts during construction will occur close to the source due to the limited height of vessels above sea level. Emissions from the larger operational vessels will occur at a greater height and impact across a wider area. In the absence of guidance, the study area applied to the onsite point source emissions has also been applied to this source also. The assessment focuses on worst-case impacts at the nearest human health and/or ecologically sensitive receptors, where present, in each direction from the vessel sources.

6.5.7 The study area for the qualitative odour assessment has, again, been determined by the guidance documents used to inform the assessment (Ref 6-25). The guidance document does not specifically refer to a study area based on any distance criteria from the site boundary. Instead, the odour study area has been assumed to include the nearest odour sensitive receptors in each direction from the Site.

6.6 Baseline Conditions

Existing Baseline

6.6.1 A desk-based study has been undertaken to inform the baseline characterisation on which the impact assessment has been based. This has included review of the following key data sources:

a. NELC Local Air Quality Management Data (Ref 6-37).

b. North Lincolnshire Council Local Air Quality Management Data (Ref 6-40).

c. A baseline nitrogen dioxide diffusion tube survey.

d. Defra's Pollution Climate Mapping ("PCM") Model Compliance Link Outputs (Ref 6-10).

e. Defra's Background Pollutant Concentration Maps (Ref 6-9).

f. APIS Background Pollutant Concentration Maps (Ref 6-2).

Local Air Quality Management Data

6.6.2 NELC undertake monitoring of air quality in their administrative area as part of their LAQM duties (Ref 6-37)). This includes the monitoring of nitrogen dioxide (NO_2) at two automatic monitoring sites and 30 passive monitoring sites. Of those monitoring sites, four are located at Immingham, including one of the automatic monitoring sites. In 2019, when conditions were not affected by the Covid-19 pandemic, concentrations ranged from 16.5 µg/m^3 to 24.5 µg/m^3 at roadside locations in the town and 13.5 µg/m^3 at an urban background location. Concentrations had generally returned to pre-pandemic levels in 2021. These data are summarised in **Table 6-6** and demonstrate concentrations below the air quality objective and below the value to suggest any risk of the one-hour NO_2 objective being exceeded.

6.6.3 North Lincolnshire Council also undertake monitoring of air quality within their administrative area using passive and automatic monitoring (Ref 6-40), including at locations in South Killingholme and adjacent to the A160. These data are summarised in **Table 6-6** and also demonstrate concentrations below the air quality objective and below the value to suggest any risk of the one-hour NO_2 objective being exceeded.

6.6.4 Both councils have current AQMAs declared. NELC have an AQMA located adjacent to the A180 through Grimsby (designated due to elevated NO_2 concentrations). The location of this AQMA is shown on **Figure 6.1 [TR030008/APP/6.3]**. NLC have a more distant AQMA located at Scunthorpe (designated due to elevated concentrations of particulate matter (PM_{10})). Immingham itself has historically had an AQMA close to the Port of Immingham on Kings Road, due to elevated concentrations of PM_{10}. However, this AQMA was revoked in 2016, to reflect PM_{10} concentrations that are now well below the relevant air quality objectives.

Table 6-6: Recorded NO_2 Concentrations in Immingham and Grimsby from North East Lincolnshire Air Quality Monitoring Network.

Site ID	Grid Reference		Site Type	NO_2 Annual Mean Concentration (µg/m^3)[1,2]						
	X	Y		2015	2016	2017	2018	2019	2021	2022
Immingham										
AURN[3]	518277	415116	Background	-	-	16.9	13.9	13.5	12.1	11.7
NEL 23[4]	519193	415279	Roadside	30.0	33.3	28.5	26.5	24.5	25.3	21.7
NEL 24[4]	517543	414312	Kerbside	-	-	-	-	16.5	15.0	14.6
NEL 25[4]	518108	414533	Kerbside	-	-	-	-	19.1	18.2	17.6
Cleethorpe Road AQMA, Grimsby										
Cleethorpe Road[2]	527761	410425	Roadside	**46.5**	**41.6**	35.9	-	32.0	33.4	29.6
NEL 11/12/13[5]	527761	410425	Roadside	**42.7**	**45.2**	**47.3**	38.0	37.8	39.1	36.7
NEL 14[4]	527754	410445	Kerbside	34.7	37.3	34.7	33.3	31.6	34.2	31.5
NEL 15[4]	527789	410438	Kerbside	30.8	35.7	37.3	32.9	31.0	35.8	31.3

[1] Values in **Bold** signify an exceedance of the annual mean NO_2 air quality objective

[2] Values for 2020 not reported due to the influence of Covid-19 lockdowns on emissions

[3] Continuous monitoring station with reference monitor

[4] Diffusion tube

[5] Triplicate diffusion tubes and average reported

Table 6-7: Recorded NO_2 concentrations in South Killingholme from North Lincolnshire Air Quality Monitoring Network

Site ID	Grid Ref.		Site Type	Annual Mean Conc. (µg/m³)[1,2]						
	X	Y		2015	2016	2017	2018	2019	2021	2022
CM6[3]	514880	416133	Other	20	17	17	18	15	14	14
DT13[4]	514573	415901	Roadside	26	31	20	17	17	17.4	16.8
DT14[4]	514782	415971	Roadside	34	31	27	28	29	28.4	27.1
DT15[4]	515452	416107	Background	19	21	19	20	18	17.9	16.7
DT16[4]	515279	416085	Roadside	27	26	25	26	25	22.0	23.8

[1] North Lincolnshire report concentrations as whole numbers

[2] Values for 2020 not reported due to the influence of Covid-19 lockdowns on emissions

[3] Continuous monitoring station with reference monitor

[4] Diffusion tube

Baseline Survey Data

6.6.5 To supplement the existing NO_2 monitoring data gathered by the Local Authorities in the study area, a project specific NO_2 survey has been undertaken from January 2023 to April 2023. The data gathered during the survey has been annualised and adjusted for diffusion tube bias in line with Defra's LAQM TG (22) guidance (Ref 6-8), to represent annual mean concentrations for 2022.

6.6.6 These results are summarised in **Table 6-8** and demonstrate concentrations below the air quality objective and below the value to suggest any risk of the one-hour NO_2 objective being exceeded. The locations of the diffusion tube monitoring sites are illustrated in **Figure 6.1 [TR030008/APP/6.3]**.

Table 6-8: Baseline NO_2 survey results, annualisation and bias-adjustment

Diffusion Tube ID	Period Mean Concentration (µg/m³)			Annualised Mean (2022)[1]	Bias-adjusted mean (2022)[2]
	Period 1 (31/01/23 – 28/02/23)	Period 2 (28/02/23 – 28/03/23)	Period 3 (28/03/23 – 26/04/23)		
DT1	25.4	20.2	23.4	23.6	19.9
DT2	20.0	18.7	16.6	18.9	15.9
DT3	19.4	20.3	16.5	19.3	16.2
DT4	26.8	26.2	23.9	26.3	22.1

Diffusion Tube ID	Period Mean Concentration (µg/m^3)			Annualised Mean (2022)[1]	Bias-adjusted mean (2022)[2]
	Period 1 (31/01/23 – 28/02/23)	Period 2 (28/02/23 – 28/03/23)	Period 3 (28/03/23 – 26/04/23)		

[1] Annualisation factor of 1.03 calculated by comparison of period mean and 2022 annual mean concentrations from the following automatic monitoring stations on the Automatic Urban and Rural Network: Immingham Woodlands Avenue (1.00), York Bootham (1.04) and Scunthorpe Town (1.03), and the North Lincolnshire Council monitoring site: South Killingholme School (1.03). The monitoring station Hull Freetown has not been used due to poor data capture during the sampling period.

[2] A bias-adjustment factor of 0.84 sourced from Defra's National Bias Adjustment Spreadsheet (Ref 6-11) which calculated from a number of co-location studies undertaken by the laboratory that prepared and analysed the diffusion tubes used in the survey.

Defra PCM Model

6.6.7 The closest PCM link to the Project is the A1173 located approximately 120m from the western edge of the site. This link has a modelled concentration of 22.6 µg/m^3 in 2019 (Ref 6-10).

Human Health Relative Background Data

6.6.8 Defra has produced publicly available maps of background pollutant concentrations covering the whole of the UK, for the purpose of LAQM (Ref 6-9). These maps provide a useful resource for locations where background monitoring data is limited. The maps give background pollutant concentrations for each 1km x 1km grid square within the UK for all years between 2018 and 2030 for NO_2, PM_{10} and $PM_{2.5}$.

6.6.9 **Table 6-9** outlines the 2022 background concentrations of NO_2, PM_{10} and $PM_{2.5}$, within the grid squares where the Project is located and where there are key features of interest to the assessment. The background concentration values account for existing sources of emissions to air within each and neighbouring grid squares and none of these sources have been removed from the values reported. Total background concentrations within these grid squares are well below the respective air quality objectives.

Table 6-9: Defra mapped annual mean background concentrations for 2022

Rec. ID	Interest Feature	Annual Mean Concentration (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
Construction Phase Receptors				
C_R1	Residential receptor on Queens Road	15.2	14.6	8.4
C_R2	Residential receptor on Queens Road	15.2	14.6	8.4

Rec. ID	Interest Feature	Annual Mean Concentration (µg/m^3)		
		NO_2	PM_{10}	$PM_{2.5}$
C_R3	Residential receptor on Queens Road	14.4	13.9	8.1
C_R4	Residential receptor on Kings Road	15.2	14.6	8.4
C_R5	Residential receptor within Grimsby AQMA	19.6	13.1	8.4
C_R6	Residential receptor within Grimsby AQMA	19.6	13.1	8.4
Operational Phase Receptors				
O_R1	Residential property on Kings Road	15.2	14.6	8.4
O_R2	Residential property on Chestnut Avenue	15.2	14.6	8.4
O_R3	Residential property on Talbot Road	15.2	14.6	8.4
O_R4	Residential property on Somerton Road	15.2	14.6	8.4
O_R5	Residential property on Kendal Road	15.2	14.6	8.4
O_R6	Residential property on Pelham Road	12.5	13.7	8.3
O_R7	Residential property on Margaret Street	12.5	13.7	8.3
O_R8	Residential property – Mauxhall Farm	11.2	15.7	8.6
O_R9	Residential property on North Moss Lane	11.3	15.4	8.4
O_R10	Residential property on South Marsh Road	11.6	15.8	8.6
O_R11	Residential property on Church Lane	9.6	15.3	8.3
O_R12	Residential property within Grimsby AQMA	19.6	13.1	8.4
O_R13	Residential property to north of the Humber Estuary	12.3	11.6	7.3
O_R14	Residential property to north of the Humber Estuary	11.7	14.7	8.1
O_R15	Residential property to north of the Humber Estuary	11.0	14.9	8.1
O_R16	Residential property to north of the Humber Estuary	11.6	14.0	7.9
O_R17	Residential property to north of the Humber Estuary	10.7	14.9	8.1
Air Quality Objective Values		**40**	**40**	**20**

Nature Conservation Relative Background Data

6.6.10 With regard to pollutants of importance to nature conservation, Defra also publish 1km x 1km grid square data for NO_X for all years between 2018 and 2030. For other pollutants, the APIS make publicly available maps of background pollutant data across the UK for SO_2, NH_3 and nitrogen deposition rates (Ref 6-2). The background concentrations for SO_2 are based on 1km x 1km grid squares whilst concentrations of NH_3 and nitrogen deposition rates are based on 5km x 5km grid squares across the UK. Each square includes for the contribution of existing sources of emissions to air within them and from other grid squares around them.

6.6.11 **Table 6-10** provides 2019 background pollutant data (based on a three-year average of 2018 – 2020 inclusive) for SO_2 and NH_3. These 2019 values are used to represent conditions in the existing baseline year of 2022, because there is no published means by which to account for any year-on-year improvements in these pollutants. The table provides 2022 background pollutant data for NO_X and nitrogen deposition. The 2022 nitrogen deposition rate background is the 2019 value provided by the APIS and the application of a yearly reduction in deposition rate of 0.07 kg/ha/yr, as published by the Joint Nature Conservation Committee's Nitrogen Futures Project (Ref 6-28).

Table 6-10: APIS mapped annual mean background concentrations and deposition rates for 2022

Rec. ID	Interest Feature	Annual Mean Conc. (µg/m^3)			Nitrogen Deposition Rate (kg/ha/yr)
		NO_X	SO_2	NH_3	
O_E1	Saltmarsh (SAC)	16.7	2.1	1.5	**15.0**
O_E2	Saltmarsh (SAC)	16.7	2.1	1.5	**15.0**
O_E3	Saltmarsh (SAC)	16.5	1.8	1.6	**14.3**
O_E4	Saltmarsh (SAC)	15.3	1.7	1.6	**14.3**
O_E5	Saltmarsh (SAC)	18.4	3.9	1.5	**15.1**
O_E6	Saltmarsh (SAC)	21.0	3.4	1.6	**16.4**
O_E7	Saltmarsh (SAC)	14.0	1.6	1.6	**14.3**
O_E8	Saltmarsh (SSSI)	16.6	2.2	1.5	**15.1**
O_E9	Saltmarsh (SAC)	17.7	1.9	1.5	**15.1**
O_E10	Saltmarsh (SAC)	28.7	2.8	1.6	**13.9**
O_E11	Saltmarsh (SAC)	23.0	3.4	1.6	**16.4**
O_E12	Saltmarsh (SAC)	**37.9**	3	1.6	**16.4**

Rec. ID	Interest Feature	Annual Mean Conc. (µg/m^3)			Nitrogen Deposition Rate (kg/ha/yr)
		NO_X	SO_2	NH_3	
O_E13	Saltmarsh (SAC)	15.0	2	1.5	**15.0**
O_E14	Saltmarsh (SAC)	13.0	1.7	2.1	**16.6**
O_E15	Saltmarsh (SAC)	13.0	1.7	2.1	**16.6**
O_E16	Grassland (LWS)	20.6	3.2	1.5	**15.1**
O_E17	Woodland (LWS)	18.2	3.53	1.6	**26.5**
O_E18	Woodland (LWS)	15.4	1.75	1.5	**25.4**
O_E19	Grassland (LWS)	14.8	2.22	1.5	**15.1**
Critical Levels and Critical Load		**30**	**20**	**3**	**10**

[1] Short vegetation, such as grassland and marsh, has a lower deposition velocity then tall vegetation, hence lower background deposition rates.

[2] Tall vegetation, such as woodland, has a higher deposition velocity than short vegetation, hence higher background deposition rates.

6.6.12 Background concentrations of SO_2 and NH_3 in 2022 are well below their respective Critical Levels. Background concentrations of NO_X are well below the Critical Level for that pollutant at most locations. There is an existing exceedance at grid square 516500,420500, the centre point of which is at the Humber Sea Terminal, and an elevated concentration at grid square 527500,410500, which includes the Port of Grimsby and North East Lincolnshire's Grimsby AQMA. Background nitrogen deposition rate date for both short vegetation and tall vegetation exceed the new lower Critical Load for saltmarsh habitat, which was confirmed by the APIS as 10 kg/ha/yr on 25 May 2023. However, nitrogen deposition rates to short vegetation do not exceed the upper Critical Load value of 20 kg/ha/yr.

Dust

6.6.13 Existing background dust levels are likely to be variable across the sites. Close to the Port and surrounding industrial/commercial areas, there are likely to be a number of dust generating activities already present and baseline levels of dust deposition and dust soiling are potentially elevated. Away from the Port and the industrial areas, dust deposition rates and dust soiling are likely to be typical of most urban, suburban, and semi-rural locations.

Future Baseline

6.6.14 The future baseline scenario provides the air quality conditions against which the impact of Project emissions is considered. Future baseline air quality differs from existing baseline air quality for several reasons. These include:

a. Increased vehicle movements on the local road network and SRN, due to traffic growth (refer to **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** regarding assumptions related to consented developments and traffic growth).

b. Reduced emissions per vehicle movement, due to improving vehicle emissions standards and the evolution of the UK vehicle fleet.

c. An overall trend of decreasing background pollutant concentrations over future years.

Local Air Quality

6.6.15 Future baseline air quality has been quantified for the year of peak construction (2026) and for the year of opening (2028), which has also been used to represent the future baseline for the year of full operation (2036). The assumption that the year of opening represents year of full operation is precautionary. Background air quality is projected to improve beyond 2028 and baseline conditions in 2036 are likely to be better than those experienced in 2028.

6.6.16 The construction phase is the only scenario that causes a traffic impact of more than the screening criteria set out in **Paragraph 6.4.17** or **Paragraph 6.4.18**. The construction traffic route that experiences a traffic impact of more than the screening criteria is from the site entrance on Queens Road and the A1173, between Queens Road and the A180. This route passes air quality human health sensitive receptors located adjacent to Queens Road. It does not pass within 200 m of a nature conservation site of national or international importance, with reference to the requirements of the Natural England guidance (Ref 6-34).

6.6.17 At the receptors that are located within 200m of the construction routes that exceed the traffic screening criteria (receptor C_R1 to C_R6), the year of peak construction baseline is based on the projected background concentration data for 2026, plus cumulative emissions associated with flows from general traffic growth and committed developments in construction or operation by 2026.

6.6.18 Future baseline air quality in 2026 is presented at selected air quality sensitive receptors located within the distances of the emissions sources, as described in **Section 6.5**. Future baseline pollutant statistics at human health sensitive receptors are reported in **Table 6-11** below. The receptors are described in **Appendix 6.B [TR030008/APP/6.4]** and their location of is illustrated in **Figure 6.1 [TR030008/APP/6.3]**.

Table 6-11: Future Baseline Concentrations at nearest human health sensitive receptors for 2026

Receptor ID	Annual Mean Background Contribution (µg/m³)[1]			Annual Mean Modelled Contribution (µg/m³)			Annual Mean Concentration (µg/m³)[3]		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
C_R1	14.1	14.2	8.0	2.7	0.8	0.4	16.8	15.0	8.5
C_R2	14.1	14.2	8.0	2.4	0.7	0.4	16.5	14.9	8.4
C_R3	13.3	13.4	7.7	2.5	0.7	0.4	15.8	14.1	8.1
C_R4	14.1	14.2	8.0	3.0	1.0	0.5	17.2	15.1	8.6
C_R5	18.0	12.7	8.0	9.4	1.9	1.1	27.4	14.6	9.1
C_R6	18.0	12.7	8.0	9.0	1.8	1.0	27.0	14.5	9.1

Notes:

[1] Background contribution of existing sources, minus the contribution from the sources specifically modelled.

[2] Model contribution, including the contribution from baseline traffic flows.

[3] Annual mean concentration is the combined contribution of background and modelled sources.

6.6.19 The future baseline conditions reported in **Table 6-11** for the year of peak construction can be summarised as follows:

a. It is demonstrated that air quality at locations adjacent to the main construction traffic routes is well below the relevant air quality objectives; and

b. There is considered to be no risk of an exceedance of an air quality objective, even within the Grimsby AQMA.

6.6.20 The operation of the Project in the year of opening (2028) and year of full operation (2036) does not cause a traffic impact that is more than the screening criteria, as set out in **Paragraph 6.4.17** or **Paragraph 6.4.18**. As such, the future baseline air quality to represent 2028 (and 2036) is based on the projected Defra background concentrations at the selected air quality sensitive receptors located within the distances of the emissions sources as described in **Section 6.5**. Future baseline pollutant statistics at human health sensitive and nature conservation receptors are reported in **Table 6-12** and **Table 6-13** below. The location of receptors is illustrated in **Figure 6.1 [TR030008/APP/6.3]**.

Table 6-12: Future Baseline Concentrations at nearest human health sensitive receptors for 2028 (also representing 2036)

Receptor ID	Annual Mean Baseline Concentration (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
O_R1	13.8	14.1	8.0
O_R2	13.8	14.1	8.0
O_R3	13.8	14.1	8.0
O_R4	13.8	14.1	8.0
O_R5	13.8	14.1	8.0
O_R6	11.1	13.2	7.9
O_R7	11.1	13.2	7.9
O_R8	9.9	15.3	8.2
O_R9	10.1	14.9	8.0
O_R10	9.9	15.3	8.2
O_R11	8.5	14.8	8.0
O_R12	17.5	12.6	8.0
O_R13	11.3	11.1	7.0
O_R14	10.6	14.3	7.7
O_R15	10.0	14.5	7.7
O_R16	10.6	13.5	7.5
O_R17	9.7	14.5	7.7
Air Quality Objective Values	**40**	**40**	**20**

Table 6-13: Future Baseline Concentrations at selected nature conservation sensitive receptors for 2028 (also representing 2036)

Rec. ID	Annual Mean Baseline Concentration			
	NO_X	SO_2	NH_3	N-dep
	µg/m³			kgN/ ha/yr
O_E1	15.1	2.1	1.5	**14.6**
O_E2	15.1	2.1	1.5	**14.6**
O_E3	14.9	1.8	1.6	**13.9**
O_E4	13.8	1.7	1.6	**13.9**
O_E5	16.6	3.9	1.5	**14.7**
O_E6	19.1	3.4	1.6	**16.0**
O_E7	12.6	1.6	1.6	**13.9**
O_E8	14.6	2.2	1.5	**14.7**
O_E9	15.8	1.9	1.5	**14.7**
O_E10	25.1	2.8	1.6	**13.5**
O_E11	21.1	3.4	1.6	**16.0**
O_E12	**36.5**	3.0	1.6	**16.0**
O_E13	13.6	2.0	1.5	**14.6**
O_E14	11.6	1.7	2.1	**16.1**
O_E15	11.6	1.7	2.1	**16.1**
O_E16	18.4	3.2	1.5	**14.7**
O_E17	16.2	3.53	1.6	**25.5**
O_E18	13.1	1.75	1.5	**26.0**
O_E19	13.0	2.22	1.5	**14.7**
Critical Levels and Critical Load	**30**	**20**	**3**	**10**

6.6.21 The future baseline conditions in 2028 (also representing 2036) reported in **Table 6-12** and **Table 6-13** can be summarised as follows:

a. At the human health sensitive receptors, air quality is of a good standard and there is considered no risk of an exceedance of an air quality objective,

b. At the sensitive nature conservation receptors, annual mean NO_X concentrations exceed the Critical Level at the location of receptor O_E12 but are below or well below the Critical Level at all other locations considered. Concentrations appear to be elevated at O_E12 because of emissions associated with the Humber Sea Terminal,

c. Annual mean concentrations of SO_2 and NH_3 are well below their respective Critical Levels,

d. Nitrogen deposition rates are in excess of the lower Critical Load value for saltmarsh habitat (10 kg/ha/yr) but also less than the upper Critical Load value at all receptors considered.

Dust

6.6.22 Future baseline dust conditions are unlikely to be perceptibly different to conditions experienced now, providing no greater source of dust emissions is introduced into the study area than those sources currently present. This is considered highly unlikely given the current use of sections of the nearby Port of Immingham for bulk cargo storage, including land to the north of the Port's East Gate.

6.7 Development Design and Impact Avoidance

6.7.1 This section sets out measures by which emissions to air are controlled by embedded design methods, or by standard practice methods secured through the DCO process. The assessment of air quality impacts set out in **Section 6.8** assumes that these measures are already in place, as there is no such scenario where they would not be.

6.7.2 It should be noted that some elements of the Project design remain flexible subject to the evolution of the Project design. To account for this flexibility, the air quality assessment is based on precautionary assumptions, such as modelling the lowest emissions release heights of those possible within the flexible design.

Embedded Measures

6.7.3 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to population and health through the process of design development, and by embedding mitigation measures into the design.

6.7.4 Emissions to air and potential impacts at sensitive locations are mitigated by direct and indirect control measures including those which will be embedded within the Project design or which will be required to obtain or secure compliance with the environmental permit which must be obtained for the operation of the hydrogen production facility ("Environmental Permit"). These measures include, but are not limited to:

a. Project layout design and the locating of defined works and associated onsite sources set out in Schedule 1 of the **draft DCO [TR030008/APP/2.1]** within the relevant work areas shown on the **Work Plans [TR030008/APP/4.2],** which has given consideration to nearby air quality sensitive receptors, including the position of the jetty and docked vessels,

b. Closed system for ammonia and hydrogen handling with leak detection management system, which will be a requirement of the Environmental Permit,

c. Emergency flares to burn off NH_3 or hydrogen emissions should the need arise; hydrogen flares will also be used in plant start up and shut down, which will be a requirement of the Environmental Permit and necessary to ensure compliance with COMAH regulations (ALARP),

d. Emissions release heights to encourage optimal dispersion – assuming the lowest emission release height of the flexible design parameters as set out in Requirement 4(4) of the draft DCO,

e. Demonstration of the application of best available techniques in plant design and operation as will be required to obtain the Environmental Permit, which the hydrogen production facility will need to comply with throughout its operational life,

f. The enforcement of relevant emissions standards including those set by MARPOL for Marine Vessels, with the Humber Estuary being part of the North Sea ECA for SO_X and NO_X, as enforced by the UK Maritime and Coastguard Agency.

Standard Measures

6.7.5 Standard measures set out within the **CEMP [TR030008/APP/6.5]** and **Construction Traffic Management Plan** ("CTMP") **[TR030008/APP/6.7]** secured by requirements of the draft DCO will reduce emissions of dust from construction activities and combustion emissions from traffic movements. The measures considered standard are set out in the following sections.

Construction Phase

Construction Dust Emissions

6.7.6 Step 3 of the IAQM construction dust guidance uses the risk of dust impacts identified in Step 2C to compile an appropriate list of dust mitigation to offset that risk and ensure that a significant effect does not occur. The IAQM guidance relevant to the construction dust assessment (Ref 6-23) lists measures that should be applied, if practical, relative to the risk identified (see **Section 6.8**).

6.7.7 A Low/Medium risk of dust impacts was identified in **Section 6.8** due to the potential dust emission magnitude and the sensitivity of the area. Therefore, the list of IAQM mitigation measures taken forward for this Project is proportionate to the risk identified. These measures will be secured through the CEMP. The measures identified for the Project are as follows, based on IAQM recommendation for low and medium risk sites:

a. Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.

b. Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.

c. Display the head or regional office contact information.

d. Develop and implement a Dust Management Plan ("DMP"), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the measures set out here and within the **Outline CEMP [TR030008/APP/6.5]**. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections, as required for the risk associated with the site.

e. Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.

f. Make the complaints log available to the local authority when asked.

g. Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

h. Hold regular liaison meetings with other construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

i. Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This would include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.

j. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.

k. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

l. Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during earthworks and construction.

m. Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.

n. Erect solid screens or barriers around dusty activities or the Site Boundary that are at least as high as any stockpiles on site.

o. Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.

p. Avoid site runoff of water or mud.

q. Keep site fencing, barriers and scaffolding clean using wet methods.

r. Remove materials that have a potential to produce dust from the Site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.

s. Cover, seed or fence stockpiles to prevent wind whipping.

t. Ensure all on-road vehicles comply with the requirements of relevant NRMM standards, where applicable.

u. Ensure all vehicles switch off engines when stationary - no idling vehicles.

v. Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

w. Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).

x. Produce a CTMP based on the **Outline CTMP [TR030008/APP/6.7]** to manage the sustainable delivery of goods and materials;

y. Implement a Construction Worker Travel Plan ("CWTP") based on the **Outline CWTP [TR0300008/APP/6.7]** that supports and encourages sustainable travel (public transport, cycling, walking, provision of multi-occupancy vehicles and car-sharing).

z. Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.

aa. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.

bb. Use enclosed chutes and conveyors and covered skips.

cc. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

dd. Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

ee. Avoid bonfires and burning of waste materials.

ff. Avoid scabbling (roughening of concrete surfaces) if possible.

gg. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

hh. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

ii. For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

jj. Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.

kk. Avoid dry sweeping of large areas.

ll. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;

mm. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.

nn. Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

oo. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.

pp. Access gates to be located at least 10 m from receptors where possible.

Construction Phase Plant and Vessel Emissions

6.7.8 It is best practice to mitigate emissions to air. Measures to reduce emissions from construction phase vessel and road traffic emissions sources include taking steps to:

a. Prohibit unnecessary vehicle or vessel movements, as specified in the CEMP.

b. Prohibit unnecessary idling of vehicle and vessel engines, as specified in the CEMP.

c. Encourage/promote the use of cleaner engines and fuels, noting that construction vessels will be required to comply with the MARPOL Regulations, as enforced by the UK Maritime and Coastguard Agency.

d. Discourage single-user car journeys as specified in the **Outline CWTP [TR0300008/APP/6.7]**.

Operational Phase

6.7.9 As stated previously, it is best practice to mitigate emissions to air. Measures to reduce operational phase sources include (as outlined within the Schedule of Mitigation **[TR030008/APP/7.2])**:

a. Implementation of an Odour Management Plan to control odour emissions, to be a requirement of the Environmental Permit.

b. Operational process and management control and monitoring of emissions to be a requirement of the Environmental Permit.

6.8 Assessment of Likely Impacts and Effects

Construction Phase

6.8.1 The assessment has identified that the construction of the Project has the potential to adversely impact on local air quality at sensitive locations in the vicinity of the Site.

6.8.2 These impacts are associated with the following pathways:

a. Dust emissions.

b. Site plant and NRMM emissions.

c. Vessel emissions.

d. Traffic emissions.

Construction Dust Emissions

6.8.3 The construction dust assessment follows the step-by-step approach set out in relevant IAQM guidance (Ref 6-23). This process is summarised in the sub-sections below. The construction dust assessment is illustrated in **Figure 6.2 [TR030008/APP/6.3]**.

6.8.4 It is anticipated that the construction of the Project will be undertaken in six phases and will last for approximately 11 years. The construction dust assessment is based on a single worst-case time-slice assuming peak construction activity and is used to represent all 11 years of construction.

6.8.5 Peak construction will occur during phase 1 of the construction works, which will last for approximately two and a half to three years and will include the construction of the following:

a. Jetty structure.

b. Jetty topside infrastructure.

c. NH_3 pipeline from the jetty.

d. Jetty access road.

e. H_2, NH_3 and Natural Gas pipelines between East and West Site.

f. Utilities and cabling to East and West Sites.

g. NH_3 tank at the East Site.

h. Internal access roads, drainage and utilities at the East Site.
i. Temporary construction area at the East Site.
j. Two hydrogen production units at the West Site.
k. One liquefier at the West Site.
l. Tanker loading bays at the West Site.
m. Trailer filling Station at the West Site.
n. Hydrogen Refuelling Station at the West Site.
o. Control room and workshop building at the West Site.
p. Other supporting building and facilities at the West Site.
q. Internal access roads, drainage and utilities at the West Site.

6.8.6 Phases 2 – 6 are anticipated to each have a duration of two years and collectively occur over a period of eight years, if built consecutively. These phases relate to increasing the capacity of the hydrogen production facility, with the installation of two additional hydrogen production units on the West Site, and three hydrogen production units and three liquefiers on the East Site. Due to the length of time over which these activities will occur, the construction works during Phases 2 – 6 will be less intensive than those undertaken during Phase 1.

Step 1 Screen the requirement for a detailed assessment

6.8.7 Step 1 of the guidance is to screen the requirement for a more detailed assessment. According to the guidance, no further assessment is required if there are no receptors within a specified distance of the works. The screening distances set by the IAQM guidance is provided in **Section 2** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

6.8.8 There are nature conservation receptors within 50m of the construction Site, including the high sensitivity Humber Estuary SAC/SPA, which is immediately adjacent to the north and north-eastern sections of the site.

6.8.9 There are human health sensitive and amenity sensitive receptors within 250m of the construction Site, the nearest being residential properties and local businesses located on Queens Road along the northern boundary of the West Site.

6.8.10 Due to the presence of the high sensitivity amenity, human health and nature conservation sensitive receptors within the screening distances set by the guidance, the more detailed assessment is required and is set out in the following steps.

Step 2 Assess the Risk of Dust Impacts

6.8.11 Step 2 is set out in **Section 3** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

Step 2A Determine the Dust Emissions Magnitude

6.8.12 Step 2A is set out in **Paragraphs 3.1.4** to **3.1.7** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]** and requires the determination of the dust emission magnitude, which the guidance states is based on the scale of the anticipated works with the following activities: demolition; earthworks; construction (i.e. the building and erection of structures); and trackout (the deposition of dust and particulate matter onto public roads by construction vehicles), and should be classified as Small, Medium, or Large.

6.8.13 There is no requirement to undertake any demolition works as part of the construction of the Project, beyond the deconstruction of a small temporary structure within the East Site that will not contribute to the generation of dust emissions from the Site.

6.8.14 The Site is anticipated to require substantial earthworks associated with soil-stripping, ground levelling and excavation works. The total ground area of earthworks is likely to meet the large criteria set by the IAQM guidance (>110,000 m^2). The number of heavy earth-moving vehicles present on site will be more than ten, although for the majority of the works, the number of earth-moving vehicles in operation at any one time is likely to be less than ten. To maintain a precautionary approach to the assessment, the dust emissions magnitude for earthworks is classed as Large, with reference to **Table A.3** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

6.8.15 Potentially dusty materials that may be in use during construction works are concrete (if delivered dry), sand and hard core, which will be stored and handled at the Site throughout the construction phase. There is also the potential that concrete batching will be undertaken on site. The volume of the construction work proposed is anticipated to meet the large criteria set by the IAQM guidance (>75,000 m^3). For these reasons, the dust emissions magnitude for construction is classed as Large, with reference to **Table A.4** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

6.8.16 Trackout is associated with the deposition of mud and potentially dusty material onto the public network from construction vehicles leaving the Site. On any one day, there will be more than 50 outward construction related HDV (all vehicles > 3.5 tonnes) movements from one or more site entrances. A proportion of the construction will pass by the residential properties located on Queens Road. The assigned dust emission magnitude for trackout is therefore classed as Large, with reference to **Table A.5** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

Step 2B Determine the Sensitivity of the Area

6.8.17 Step 2B of the IAQM construction dust guidance is set out in **Paragraphs 3.1.8** and **3.1.9** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]** requires the determination of the sensitivity of the area to construction dust impacts. According to the guidance, this is based on the sensitivity of individual receptors, the number and proximity of those receptors to

the construction works, background PM_{10} concentrations and site-specific factors, such as local terrain, meteorology, and natural and existing windbreaks.

6.8.18 The limited number of receptors combined with their proximity to the Site, means that the sensitivity of the area to dust soiling effects on people and property is Medium, with reference to **Table A.1** and **Table A.6** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

6.8.19 Background PM_{10} concentrations are estimated to be 13 – 15 µg/m^3 and this, coupled with the limited number of receptors and their proximity to the Site, means that the sensitivity of the area to human health impacts is Low, with reference to **Table A.1** and **Table A.7** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

6.8.20 The proximity of the Humber Estuary SAC/SPA means that there is a high sensitivity nature conservation receptor within 20m of the construction Site Boundary. However, the areas of the SAC/SPA that are within 20m of the Site Boundary are tidal mudflats, which are not considered sensitive to construction dust impacts, due to the absence of vegetation within the habitat to be affected and any material deposited being washed away with the retreating tide. However, the Applicant is keen to demonstrate a high level of commitment to the control of impacts from the Site, and the sensitivity with regards to nature conservation is assigned as Medium, with reference to **Table A.1** and **Table A.8** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**.

Step 2C Determine the Risk of Dust Impacts

6.8.21 Step 2C of the IAQM construction guidance is set out in **Paragraph 3.1.10** and **Table A.9** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]** and concerns the determination of the risk of dust impacts, which is informed by the dust emission magnitude identified in Step 2A and the sensitivity of the area identified in Step 2B.

6.8.22 The risk of dust impacts is shown in **Table 6-14**.

Table 6-14: Summary Dust Risk Table

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	N/A	Medium	Medium	Medium
Human health	N/A	Low	Low	Low
Nature Conservation	N/A	Medium	Medium	Medium

Step 4 Define Impacts and their Significance

6.8.23 Step 3 of the IAQM construction dust guidance (Ref 6-23) is presented in **Paragraph 6.7.6** and **6.7.7** and describes the mitigation measures required to offset the risk of dust impacts identified in Step 2 of the assessment. Step 4 of the guidance is described in **Section 5** of **Appendix 6.A: Construction Phase Assessment Method [TR030008/APP/6.4]**. This Step is simply to confirm that if

the standard practice mitigation measures described in **Paragraph 6.7.7**, which are secured through the DCO process by the **Outline CEMP** in **Appendix 2.C [TR030008/APP/6.5]**, are adhered to throughout the works, they are capable of controlling emissions to the extent that effect of construction dust impacts is **Minor Adverse** at worst and **Not Significant**.

Non-Road Mobile Machinery ("NRMM") and Site Plant

6.8.24 Peak construction will occur during phase 1 and the NRMM and site plant anticipated to be present onsite across the Pipeline Corridor, West Site and East Site, at any one time during this phase of the works, is summarised in **Table 6-15**.

Table 6-15: Summary Dust Risk Table

Plant	Units on site	Months on site	Hours on site per unit per annum	% hours on site per unit per annum
Diesel generator 550 kW	4	20	2882	33
Diesel generator 450 kW	4	18	2594	30
Transformer 2x630 kW	4	22	3170	36
Crawler crane	4	12	1729	20
Truck crane, capacity <100Te	6	20	2882	33
Truck crane, capacity >100 t	6	16	2306	26
Telehandler	6	24	3459	39
Piling rig	10	10	1441	16
Concrete mixer	20	12	1729	20
Pump	3	3	432	5
Tracked Front Loader	4	12	1729	20
Wheel loaders	4	12	1729	20
Wheel loaders/excavators	2	12	1729	20
Tracked excavators	6	12	1729	20
Dumpers	6	12	1729	20
Compacting equipment:	2	12	1729	20
Four-axle dump truck	12	6	865	10
Three-axle dump truck	2	6	865	10

6.8.25 The NRMM and site plant listed above may be present onsite at the same time but will never all be operational at the same time. The operation of all individual NRMM and site plant is limited to as and when required, within the working day. On average, it is anticipated that NRMM and site plant will be operational for 1,752 hours per year, or 22% of a year. This is based on the Project assumption that operation could occur for 70% of each 9.5-hour working day, of which there are 264 working days per year.

6.8.26 The NRMM and site plant listed above will also be distributed between the East Site, the West Site, and the Pipeline Corridor works areas.

6.8.27 The East Site works area is immediately adjacent to the Humber Estuary SAC, although the nearest sections of the SAC to the Site are not considered sensitive to air quality impacts. The nearest nature conservation sensitive locations considered to be sensitive to air quality impact are the saltmarsh habitat, approximately 3km away to the southeast. Site plant and NRMM, like road vehicles, have exhausts at near ground level, meaning that impacts are likely to only occur within close proximity of the source, and will drop off quickly with increasing distance from the source.

6.8.28 The West Site is located immediately adjacent to a small number of residential properties (c.10) alongside its northern boundary, on Queens Road. Beyond those, the nearest residential properties are located on Chestnut Avenue, 460m away to the west. The Queens Road properties are also the nearest air quality sensitive receptors to the Pipeline Corridor works area, and the East Site works area, albeit with a greater setback distance (c.100m to the nearest property from the Pipeline Corridor works area and 750m from the East Site works area).

6.8.29 Whilst the properties on Queens Road are in close proximity to the West Site boundary, they will experience some setback from the main area of works within that site. Any NRMM machinery or site plant that is operational within 100m of those properties will only be so for a limited number of days or weeks at most, with the vast majority of operations occurring within the works area being more than 100m away.

6.8.30 Air quality at the receptors on Queens Road during the year of peak construction is predicted to be of a good standard, with no risk of an exceedance of an air quality objective.

6.8.31 In light of this, the intermittent nature of NRMM and site plant emissions, and the limited number of receptors close enough to be potentially impacted upon, and the good standard of air quality at the nearest sensitive receptors, it is considered that the effect of impacts from this source are **not significant**, before mitigation. NRMM and site plant emissions would not contribute to a significant effect on local air quality.

Marine Vessel Emissions

6.8.32 Peak construction vessel operation will also occur during Phase 1, when the jetty structure and berth, and jetty topside infrastructure will be constructed. Anticipated construction phase vessels will comprise:

a. Jack-up barges (likely two in operation at any one time) used for piling operations.

a. Tugs (likely one) used for repositioning the barge(s) into new pilling locations and for moving flat top supply barges from marine load-out to the work location.

b. Multi-cats (likely two) used to resupply the barge(s) with piles, plant, consumables and associated jetty fabrications.

c. Flat top barges (likely three) used to transport equipment to the work area, house plant etc.

d. Floating barges (likely two) with a crane used to undertake lifting operation.

e. Safety boat (likely one) used to support operations and assist with crew transfers.

f. Dredging vessels formed of backhoe dredger and split hopper barges.

6.8.33 During the jetty construction, it is anticipated that the tug, multi-cat vessels and a safety boat would be operating in the construction area daily. It is anticipated that multiple barge moves would be undertaken each week.

6.8.34 The closest human health sensitive receptors to the construction phase vessel working area are the residential properties on Queens Road, approximately 1.5km away from the nearest marine works and 2.5km away from the furthest marine works.

6.8.35 The construction vessel working area is immediately adjacent to the Humber Estuary SAC, although, as previously noted, the nearest sections of the SAC to the Site are not considered sensitive to air quality impacts. The sensitive locations of the SAC are the saltmarsh habitat, approximately 3km away to the northeast and 3km to the southeast.

6.8.36 Given the limited number of construction vessel emissions sources, the frequency of their operation over the course of a year and distance between source and sensitive receptors, it is considered highly likely that the effect of impacts from this source would be **not significant**. Construction vessel emissions would not contribute to a significant effect on air quality.

Road Traffic Emissions

6.8.37 Peak construction traffic impacts are anticipated to occur in 2026, during the first phase of the Project construction works. During that Phase, there is anticipated to be an annual daily average of 1,451 two-way construction-related LDV movements and 199 two-way HDV movements between the West Site access and the Kings Road/A1173 junction, and 729 two-way construction-related LDV movements and 60 two-way HDV movements between the West Site access Queens Road and Laporte Road, Immingham. There is also anticipated to be an increase of 805 two-way construction-related LDV movements and 199 two-way HDV movements on the A1173 between Queens Road and the A180. Such a traffic impact exceeds the non-AQMA screening criteria set out in **Paragraph 6.4.17**.

6.8.38 There are also anticipated to be an annual daily average of 412 two-way construction-related LDV movements and 90 two-way HDV movements on Cleethorpe Road, Grimsby. Such a traffic impact exceeds the AQMA screening criteria set out in **Paragraph 6.4.17**.

6.8.39 All traffic impacts on other local roads either occur where there are no sensitive receptors within 200m of the road, or to the extent that the screening criteria in **Paragraph 6.4.17** is not exceeded. All traffic impacts on the SRN do not exceed the screening criteria set out in **Paragraph 6.4.18** with regards to human health (Ref 6-33) and nature conservation (Ref 6-34).

6.8.40 **Table 6-16** presents the construction phase air quality impact of the Project, and the assessment is illustrated in **Figure 6.2 [TR030008/APP/6.3]**. It demonstrates that the modelled sources account for less than 1% of the air quality objectives for annual mean NO_2, PM_{10} and $PM_{2.5}$. At locations where total concentrations with the Project under construction are less than 75% of the air quality objectives, the impact is deemed to be negligible, in line with industry standard guidance (Ref 6-32).

Table 6-16: Construction Phase Concentrations at nearest human health sensitive receptors for 2026

Receptor ID	Annual Mean Background Contribution (µg/m³)[1]			Annual Mean Modelled Baseline Contribution (µg/m³)[2]			Annual Mean Modelled IGET Contribution (µg/m³)[3]			Annual Mean Concentration (µg/m³)[4]		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
C_R1	14.1	14.2	8.0	1.9	0.8	0.4	0.2	0.2	0.1	16.2	15	8.5
C_R2	14.1	14.2	8.0	1.7	0.7	0.4	0.2	0.1	0.1	15.9	15	8.5
C_R3	13.3	13.4	7.7	1.6	0.7	0.4	0.2	0.1	0.1	15.1	14.4	8.3
C_R4	14.1	14.2	8.0	2.2	1.0	0.5	0.1	<0.1	<0.1	16.4	17.9	10.1
C_R5	18.0	12.7	8.0	6.2	1.9	1.1	0.1	<0.1	<0.1	24.4	14.6	9.1
C_R6	18.0	12.7	8.0	5.9	1.8	1.0	0.1	<0.1	<0.1	24.1	13.1	8.3

Notes:

[1] Background contribution of existing sources, minus the contribution from the sources specifically modelled.

[2] Model contribution, including the contribution from the IERRT project and other cumulative sources.

[3] Modelled contribution from IGET construction traffic emissions.

[4] Annual mean concentration is the combined contribution of background and modelled sources.

6.8.41 Annual mean concentrations of NO_2 and PM_{10} are low to the extent that there is considered no risk of the hourly mean air quality objective for NO_2, nor the daily mean objective for PM_{10} being exceeded due to the Project.

6.8.42 In line with the industry standard IAQM/EPUK guidance and following review of baseline air quality on Queens Road and the wider study area, it is considered that the construction phase traffic impact will not contribute to a significant effect on local air quality. Before mitigation, the effect of the construction phase road traffic emissions impact is **not significant**.

Operational Phase

6.8.43 This section contains an assessment of the potential impacts to air quality as a result of the operational phase of the Project. The following impact pathways have been assessed:

a. Onsite marine-side vessel emissions and landside combustion and process emissions.

b. Road traffic emissions.

c. Odour emissions.

Marine Vessel Emissions and Landside Plant Emissions

6.8.44 Exhaust emissions from operational phase vessels in motion have the potential to impact on local air quality. Whilst in motion, the vessel emissions source is transient and will impact a specific location for the period in which the vessel passes that location, subject to the wind direction at that time. It is assumed that there could be up to 292 vessel calls associated with the Project per year, which equates to 0.8 calls per day, or 1.6 two-way vessel movements per day. Assuming a vessel speed of 10 to 20 knots (19 km/hr to 37 km/hr), a specific location will be within 10km of the transient vessel emissions for 32 minutes per day at a speed of ten knots and 16 minutes per day at a speed of 20 knots. With 292 vessel calls assumed per year (584 two-way movements), this will account for 3.5% of the year and 1.8% of the year respectively, assuming the wind will always blow from the source to each receptor. Given the variable nature of wind direction, exposure of any one location to transient vessel emissions will be even lower. Such a transient and intermittent emission source is considered unlikely to impact to the extent that they will contribute to a significant air quality effect. Emissions from vessels in motion during operation have not therefore been quantified in this assessment.

6.8.45 It is also noted that the number of operational vessel movements associated with the Project (584 two-way movements per year) falls well below the DEFRA LAQM-TG(22) guidance criteria (Ref 6-8), which states that for the purpose of LAQM, emissions from port expansions may only need to be considered where:

a. There are more than 5,000 ship movements per year (i.e. cross-channel ferries, roll on-roll off ships, bulk cargo, container ships, cruise liners, etc – one ship generating two movements (arrival and departure)), with relevant exposure within 250m of the berths and main areas of manoeuvring.

b. There are more than 15,000 large ship movements per year, with relevant exposure within 1km of these areas.

6.8.46 The impact of docked vessel emissions and onsite plant emissions has been quantified in line with the methodology set out in **Paragraph 6.4.26** to **6.4.35** and **Appendix 6.B** [**TR030008/APP/6.4**]. Assessment assumptions used to inform the quantification of these impacts are listed in **Paragraphs 6.4.59.6.4.57**

6.8.47 **Table 6-17** and **Table 6-18** present the operational phase air quality impact of the Project on the selected human health sensitive receptors considered in this assessment (see **Paragraph 6.4.39** and **Section 6** of **Appendix 6B [TR030008/APP/6.4]**. The assessment is illustrated in **Figure 6.3 [TR030008/APP/6.3]** (Figures 6.3(A1) and 6.3(A2) assuming MARPOL Tier III vessel emissions and Figures 6.3(B1) and 6.3(B2) assuming MARPOL Tier III vessel emissions.

6.8.48 **Table 6-17** provides contributions and concentrations if all vessels calling at the Project will conform to the MARPOL Regulation 13 Tier III NO_X emissions standard (as introduced in **Paragraph 6.4.60**). **Table 6-18** provides contributions and concentrations assuming that all vessels calling at the Project will conform to the MARPOL Regulation 13 Tier II NO_X emissions standard. It is impossible to estimate the proportion of Tier II and Tier III vessels using the facility in 2028 or 2036, but it is a certainty that all vessels will be Tier II compliant as a minimum. Therefore, the actual impact at each receptor is likely to be somewhere between the two values reported in **Table 6-17** and **Table 6-18**. Something that is certain though, is that Tier II vessels will reduce year on year and Tier III vessels will increase year on year, as older vessels or vessel engines are replaced or retrofitted with new technology.

6.8.49 **Table 6-17** demonstrates that with vessels complying with MARPOL Tier III emissions standards, modelled Project sources account for less than 1% of the air quality objectives for annual mean NO_2 (0.4 µg/m^3), PM_{10} (0.4 µg/m^3) and $PM_{2.5}$ (0.2 µg/m^3). At locations where total concentrations with the Project in operation are less than 75% of the air quality objectives (30 µg/m^3) for NO_2 and PM_{10}, and 15 µg/m^3 for $PM_{2.5}$), the impact is deemed to be negligible, in line with industry standard guidance (Ref 6-32).

6.8.50 **Table 6-18** demonstrates that with vessels complying with MARPOL Tier II emissions standards, modelled Project sources account for less than 1% of the air quality objectives for annual mean PM_{10} and $PM_{2.5}$ at all locations and for annual mean NO_2 at around half of the locations. Impacts of more than 1% of the air quality objective for annual mean NO_2 are predicted at receptors O_R1 (1%), O_R4 (1%), O_R5 (1%), O_R13 (3%), O_R14 (1%), O_R15 (1%), O_R16(2%) and O_R17 (2%). At locations where total concentrations with the Project in operation are less than 75% of the air quality objectives, the impact is still deemed to be negligible, in line with industry standard guidance (Ref 6-32).

Table 6-17: Operational concentrations at nearest human health sensitive receptors for 2028 (also representing 2036) – Assuming MARPOL Tier III Emissions Standards (with SCR)

Receptor ID	Annual Mean Background Contribution (µg/m³)		Annual Mean Modelled IGET Contribution (µg/m³)			Annual Mean Concentration (µg/m³)			
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
O_R1	13.8	14.1	8.0	0.3	<0.1	<0.1	14.1	14.1	8.0
O_R2	13.8	14.1	8.0	0.2	<0.1	<0.1	14.1	14.1	8.0
O_R3	13.8	14.1	8.0	0.2	<0.1	<0.1	14.1	14.1	8.0
O_R4	13.8	14.1	8.0	0.3	<0.1	<0.1	14.1	14.1	8.0
O_R5	13.8	14.1	8.0	0.3	<0.1	<0.1	14.2	14.1	8.0
O_R6	11.1	13.2	7.9	0.1	<0.1	<0.1	11.2	13.2	7.9
O_R7	11.1	13.2	7.9	0.1	<0.1	<0.1	11.2	13.2	7.9
O_R8	9.9	15.3	8.2	0.2	<0.1	<0.1	10.0	15.3	8.2
O_R9	10.1	14.9	8.0	0.1	<0.1	<0.1	10.2	14.9	8.0
O_R10	9.9	15.3	8.2	0.1	<0.1	<0.1	10.0	15.3	8.2
O_R11	8.5	14.8	8.0	0.1	<0.1	<0.1	8.6	14.8	8.0
O_R12	17.5	12.6	8.0	<0.1	<0.1	<0.1	17.5	12.6	8.0
O_R13	11.3	11.1	7.0	0.3	<0.1	<0.1	11.6	11.1	7.0
O_R14	10.6	14.3	7.7	0.1	<0.1	<0.1	10.8	14.3	7.7
O_R15	10.0	14.5	7.7	0.2	<0.1	<0.1	10.2	14.5	7.7
O_R16	10.6	13.5	7.5	0.2	<0.1	<0.1	10.8	13.5	7.5
O_R17	9.7	14.5	7.7	0.2	<0.1	<0.1	9.9	14.5	7.7

Table 6-18: Operational concentrations at nearest human health sensitive receptors for 2028 (also representing 2036) – Assuming MARPOL Tier II Emissions Standard (without SCR)

Receptor ID	Annual Mean Background Contribution (µg/m³)[1]			Annual Mean Modelled IGET Contribution (µg/m³)			Annual Mean Concentration (µg/m³)[4]		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
O_R1	13.8	14.1	8.0	0.4	<0.1	<0.1	14.3	14.1	8.0
O_R2	13.8	14.1	8.0	0.4	<0.1	<0.1	14.2	14.1	8.0
O_R3	13.8	14.1	8.0	0.4	<0.1	<0.1	14.2	14.1	8.0
O_R4	13.8	14.1	8.0	0.4	<0.1	<0.1	14.3	14.1	8.0
O_R5	13.8	14.1	8.0	0.5	<0.1	<0.1	14.3	14.1	8.0
O_R6	11.1	13.2	7.9	0.3	<0.1	<0.1	11.4	13.2	7.9
O_R7	11.1	13.2	7.9	0.2	<0.1	<0.1	11.3	13.2	7.9
O_R8	9.9	15.3	8.2	0.3	<0.1	<0.1	10.1	15.3	8.2
O_R9	10.1	14.9	8.0	0.3	<0.1	<0.1	10.4	14.9	8.0
O_R10	9.9	15.3	8.2	0.2	<0.1	<0.1	10.1	15.3	8.2
O_R11	8.5	14.8	8.0	0.2	<0.1	<0.1	8.7	14.8	8.0
O_R12	17.5	12.6	8.0	0.1	<0.1	<0.1	17.5	12.6	8.0
O_R13	11.3	11.1	7.0	1.0	<0.1	<0.1	12.3	11.1	7.0
O_R14	10.6	14.3	7.7	0.4	<0.1	<0.1	11.1	14.3	7.7
O_R15	10.0	14.5	7.7	0.5	<0.1	<0.1	10.6	14.5	7.7
O_R16	10.6	13.5	7.5	0.7	<0.1	<0.1	11.3	13.5	7.5
O_R17	9.7	14.5	7.7	0.6	<0.1	<0.1	10.3	14.5	7.7

6.8.51 Annual mean concentrations of NO_2 and PM_{10} are low to the extent that there is considered no risk to the hourly mean air quality objective for NO_2, nor the daily mean objective for PM_{10} (see **Paragraph 6.4.52**). Modelled contributions of hourly NO_2 and daily PM_{10} from point source emissions considered in this assessment, with or without SCR technology, account for less than 10% of the air quality objectives.

6.8.52 In line with the industry standard IAQM/EPUK guidance and following review of baseline air quality on Queens Road and the wider study area, it is considered that the operational phase Project impacts will not contribute to a significant effect on local air quality. The effect of the operational phase emissions impact on human health is **not significant**.

6.8.53 **Table 6-19** and **Table 6-20** present the operational phase air quality impact of the Project on the selected nature conservation sensitive receptors considered in this assessment (see **Paragraph 6.4.39** and **Section 6** of **Appendix 6B [TR030008/APP/6.4]**. The assessment is illustrated in **Figure 6.3 [TR030008/APP/6.3]** (Figures 6.3(A1) and 6.3(A2) assuming MARPOL Tier III vessel emissions and Figures 6.3(B1) and 6.3(B2) assuming MARPOL Tier III vessel emissions.

6.8.54 **Table 6-19** provides contributions and concentrations assuming that all vessels calling at the Project will conform to the MARPOL Regulation 13 Tier III NO_X emissions standard. **Table 6-20** provides contributions and concentrations assuming that all vessels calling at the Project will conform to the MARPOL Regulation 13 Tier II NO_X emissions standard.

6.8.55 **Table 6-19** demonstrates that with vessels complying with MARPOL Tier III emissions standards, modelled Project sources account for 1% or less of the Critical Level for annual mean NO_X at all but two receptor locations in the SAC (O_E1 and O_E2) and the LWS receptor adjacent to the East Site (O_E16). At the two SAC receptors, total NO_X concentrations account for 52% of the Critical Level. At the LWS receptor, total NO_X concentrations account for 64% of the Critical Level.

6.8.56 With MARPOL Tier III emissions standards, modelled IGET sources account for 1% or less of the Critical Levels for SO_2 and NH_3 and the Critical Load for nitrogen deposition at all receptors considered in the SAC and three of the LWS receptors considered, noting that the IAQM state that the 1% screening criteria should not be used rigidly and not to a numerical precision greater than the expression of the criteria themselves (Ref 6-24). An impact of 2% of the Critical Load is predicted at the LWS adjacent to the East Site (O_E16).

6.8.57 **Table 6-20** demonstrates that with vessels complying with MARPOL Tier II emissions standards, modelled Project sources account for 1% or less of the Critical Level for annual mean NO_X at all but three receptor locations in the SAC (O_E1, O_E2 and O_E3), and at the LWS receptors adjacent the East Site (O_E16). At the three SAC locations, total NO_X concentrations account for 56% of the Critical Level at most, and at the LWS location, 66% of the Critical Level.

6.8.58 With MARPOL Tier II emissions standards, modelled Project sources account for 1% or less of the Critical Levels for SO_2 and NH_3. Project sources account for 1% or less of the Critical Load for nitrogen deposition at all but two receptors in the SAC (O_E1 and O_E2), with an impact of 1.7% and 1.9% respectively, and at the LWS receptor adjacent to the East Site, with and impact of 2%. At these locations, the Critical Load for nitrogen deposition is already exceeded by the background contribution alone with the Project contribution accounting for just 1% of the total nitrogen deposition rate predicted at these locations.

6.8.59 In **Table 6-19** and **Table 6-20**, receptor O_E12 experiences an annual mean NO_X concentration in excess of the Critical Level for that pollutant. However, the contribution from the Project account for less than 1% of the Critical Level at that location.

Table 6-19: Operational concentrations and deposition rates at selected nature conservation sensitive receptors for 2028 (also representing 2036) – Assuming MARPOL Tier III Emissions Standards (with SCR)

Rec. ID	Annual Mean Background Contribution (µg/m³)[1]				Annual Mean Modelled IGET Contribution (µg/m³)[3]				Annual Mean Concentration/ Deposition Rate (µg/m³)[4]			
	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep
	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr
O_E1	15.1	2.1	1.5	**14.6**	0.5	<0.1	0.01	0.10	15.6	2.1	1.6	**14.7**
O_E2	15.1	2.1	1.5	**14.6**	0.5	<0.1	0.01	0.11	15.7	2.1	1.6	**14.7**
O_E3	14.9	1.8	1.6	**13.9**	0.2	<0.1	<0.01	0.04	15.1	1.8	1.6	**13.9**
O_E4	13.8	1.7	1.6	**13.9**	0.2	<0.1	<0.01	0.03	13.9	1.7	1.6	**13.9**
O_E5	16.6	3.9	1.5	**14.7**	0.1	<0.1	<0.01	0.03	16.7	3.9	1.5	**14.7**
O_E6	19.1	3.4	1.6	**16.0**	0.1	<0.1	<0.01	0.02	19.2	3.4	1.6	**16.0**
O_E7	12.6	1.6	1.6	**13.9**	0.1	<0.1	<0.01	0.02	12.7	1.6	1.6	**13.9**
O_E8	14.6	2.2	1.5	**14.7**	<0.1	<0.1	<0.01	0.01	14.6	2.2	1.5	**14.7**
O_E9	15.8	1.9	1.5	**14.7**	<0.1	<0.1	<0.01	0.01	15.8	1.9	1.5	**14.7**
O_E10	25.1	2.8	1.6	**13.5**	<0.1	<0.1	<0.01	0.01	25.2	2.8	1.6	**13.5**
O_E11	21.1	3.4	1.6	**16.0**	<0.1	<0.1	<0.01	0.01	21.2	3.4	1.6	**16.0**
O_E12	36.5	3.0	1.6	**16.0**	<0.1	<0.1	<0.01	0.01	**36.5**	3.0	1.6	**16.0**
O_E13	13.6	2.0	1.5	**14.6**	0.1	<0.1	<0.01	0.01	13.7	2.0	1.5	**14.6**
O_E14	11.6	1.7	2.1	**16.1**	<0.1	<0.1	<0.01	0.01	11.7	1.7	2.1	**16.1**
O_E15	11.6	1.7	2.1	**16.1**	<0.1	<0.1	<0.01	0.01	11.7	1.7	2.1	**16.1**
O_E16	18.4	3.2	1.5	**14.7**	0.8	<0.1	0.02	0.20	19.2	3.2	1.6	**14.9**
O_E17	16.2	3.53	1.6	**25.5**	0.1	<0.1	<0.01	0.03	18.5	3.5	1.6	**25.5**
O_E18	13.1	1.75	1.5	**26.0**	0.1	<0.1	<0.01	0.03	18.5	1.8	1.5	**26.1**

Rec. ID	Annual Mean Background Contribution (µg/m³)[1]				Annual Mean Modelled IGET Contribution (µg/m³)[3]				Annual Mean Concentration/ Deposition Rate (µg/m³)[4]			
	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep
	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr
O_E19	13.0	2.22	1.5	**14.7**	0.1	<0.1	<0.01	0.02	18.5	2.2	1.5	**14.7**

Table 6-20: Operational concentrations and deposition rates at selected nature conservation sensitive receptors for 2028 (also representing 2036) – Assuming MARPOL Tier II Emissions Standard (without SCR)

Rec. ID	Annual Mean Background Contribution (µg/m³)[1]				Annual Mean Modelled IGET Contribution (µg/m³)[3]				Annual Mean Concentration/ Deposition Rate (µg/m³)[4]			
	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep
	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr
O_E1	15.1	2.1	1.5	**14.6**	1.5	<0.1	0.01	0.17	16.6	2.1	1.5	**14.8**
O_E2	15.1	2.1	1.5	**14.6**	1.6	<0.1	0.01	0.19	16.8	2.1	1.5	**14.8**
O_E3	14.9	1.8	1.6	**13.9**	0.6	<0.1	<0.01	0.07	15.5	1.8	1.6	**14.0**
O_E4	13.8	1.7	1.6	**13.9**	0.4	<0.1	<0.01	0.05	14.2	1.7	1.6	**14.0**
O_E5	16.6	3.9	1.5	**14.7**	0.3	<0.1	<0.01	0.04	16.9	3.9	1.5	**14.7**
O_E6	19.1	3.4	1.6	**16.0**	0.2	<0.1	<0.01	0.03	19.4	3.4	1.6	**16.0**
O_E7	12.6	1.6	1.6	**13.9**	0.3	<0.1	<0.01	0.04	12.9	1.6	1.6	**13.9**
O_E8	14.6	2.2	1.5	**14.7**	0.1	<0.1	<0.01	0.02	14.7	2.2	1.5	**14.7**
O_E9	15.8	1.9	1.5	**14.7**	0.1	<0.1	<0.01	0.01	15.9	1.9	1.5	**14.7**
O_E10	25.1	2.8	1.6	**13.5**	0.1	<0.1	<0.01	0.01	25.2	2.8	1.6	**13.5**
O_E11	21.1	3.4	1.6	**16.0**	0.1	<0.1	<0.01	0.02	21.2	3.4	1.6	**16.0**
O_E12	**36.5**	3.0	1.6	**16.0**	0.1	<0.1	<0.01	0.01	**36.6**	3.0	1.6	**16.0**
O_E13	13.6	2.0	1.5	**14.6**	0.1	<0.1	<0.01	0.02	13.7	2.0	1.5	**14.6**
O_E14	11.6	1.7	2.1	**16.1**	0.1	<0.1	<0.01	0.01	11.7	1.7	2.1	**16.1**

Rec. ID	Annual Mean Background Contribution (µg/m³)[1]				Annual Mean Modelled IGET Contribution (µg/m³)[3]				Annual Mean Concentration/ Deposition Rate (µg/m³)[4]			
	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep	NO_X	SO_2	NH_3	N-dep
	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr	µg/m³			kgN/ ha/yr
O_E15	11.6	1.7	2.1	**16.1**	0.1	<0.1	<0.01	0.01	11.7	1.7	2.1	**16.1**
O_E16	18.4	3.2	1.5	**14.7**	1.5	<0.1	0.02	0.25	19.9	3.2	1.6	**14.9**
O_E17	18.4	3.5	1.6	**25.5**	0.3	<0.1	<0.01	0.04	18.7	3.5	1.6	**25.5**
O_E18	18.4	1.8	1.5	**26.0**	0.3	<0.1	<0.01	0.05	18.8	1.8	1.5	**26.1**
O_E19	18.4	2.2	1.5	**14.7**	0.2	<0.1	<0.01	0.03	18.6	2.2	1.5	**14.7**

6.8.60 In **Table 6-19**, the contribution to annual mean NO_X concentrations from the Tier III vessel emissions accounts for around 70% of the impact and site emissions around 30% of the impact at the worst affected receptors in the SAC (O_E1 and O_E2). Elsewhere, there is a relatively even split between the contribution from vessels and site. The contribution to nitrogen deposition from the Tier III vessel emissions accounts for around 58% of the impact and site emissions around 42% of the impact at those worst affected receptors. Elsewhere, site emissions account for a greater proportion of the nitrogen deposition impact. For the results shown in **Table 6-20**, Tier II vessel emissions account for 80-90% of the annual mean NO_X impact at the majority of receptors, and 60-80% of the nitrogen deposition impact at the worst affected receptors.

6.8.61 The effect of impacts on nature conservation receptors is described in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. In summary:

a. For saltmarsh, the APIS provides a Critical Load range of 10-20 kg/ha/yr and nitrogen inputs have been experimentally demonstrated to have an effect on overall species composition of saltmarsh. However, the Critical Loads on APIS are relatively generic for each habitat type and cover a wide range of deposition rates. They do not (and are not intended to) take other influences (to which the habitat on a given site may be exposed) into consideration.

b. Moreover, it is important to note from APIS that the experimental studies which underlie conclusions regarding the sensitivity of saltmarsh have "… *neither used very realistic N doses nor input methods i.e. they have relied on a single large application more representative of agricultural discharge"*, which is far in excess of anything that would be deposited from atmosphere. Therefore, APIS indicates that determining which part of the critical load range to use for saltmarsh requires expert judgement. Overall, there is good reason to believe the upper part of the critical load range (20 kgN/ha/yr) may be more appropriate than the lower part (10 kgN/ha/yr) for upper saltmarsh.

c. Generally, nitrogen inputs from the air are not as important to plants as nitrogen from other sources. Effects of nitrogen deposition from atmosphere are likely to be dominated by much greater impacts from marine or agricultural sources. This is reflected on APIS itself, which states regarding saltmarsh that '*Overall, N deposition [from atmosphere] is likely to be of low importance for these systems as the inputs are probably significantly below the large nutrient loadings from river and tidal inputs'*. Another mitigating factor is that the nature of intertidal saltmarsh in the Humber estuary means that there is daily flushing from tidal incursion. This is likely to further reduce the role of nitrogen from atmosphere in controlling botanical composition.

6.8.62 In **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** it is determined that the additional predicted contribution from nitrogen emissions from the Project does not result in any exceedance of the Critical Load range for saltmarsh, as the highest deposition rate reported in **Table 6-20** is less than 20 kg N/ha/yr. The operation of the Project does not cause an exceedance of the Critical Levels for NO_X, NH_3 or SO_2. It is therefore concluded that there will be a neutral impact on the Humber Estuary designated site, which gives rise to a neutral effect that is **insignificant**.

Road Traffic Emissions

6.8.63 During the operational phase, the Project will generate a maximum increase in annual daily average traffic movements on Queens Road and the A1173, between Queens Road and the A180, which will account for 123 to 190 two-way LDV movements and 96 two-way HDV movements. There are no human health or nature conservation receptors within 200m of these roads. On all other local roads the annual daily average traffic flow will increase by between 20 to 67 two-way LDV movements and there will be zero HDV movements. On the SRN, the annual daily average traffic flow will increase by between 23 to 63 two-way LDV movements and between 44 and 52 two-way HDV movements.

6.8.64 Where there are receptors sensitive to changes in air quality, traffic impacts fall well below the screening criteria described in **Paragraph 6.4.17** or **Paragraph 6.4.18**. It is also noted that there are no nature conservation sites with a European designation with 200m of any road affected by the operation of the Project. As such, it is considered that the impact of operation traffic emissions will not contribute to a significant effect on local air quality. Before mitigation, the effect of the operational phase emissions impact on human health is **not significant**.

Odour

6.8.65 The odour impact assessment is summarised in **Table 6-21**. The table sets out the factors used to determine the likely odour impacts and resulting effect from Project sources. It follows the stepped approach described in IAQM guidance (Ref 6-25). The Project is not expected to be a significant source of odour emissions, due to the contained nature of the process system. However, with all such systems, there is the risk of fugitive emissions from potential leaks and/or accidents.

Table 6-21: Odour Impact Assessment

IAQM Guidance Criteria	Assessment of Project Conditions
A description of existing baseline odour conditions.	The East Site is located adjacent to the eastern extent of the Port of Immingham and has existing industrial facilities as neighbours, including petroleum storage and chemical manufacturing. The wider port area, petroleum storage and chemical manufacturing are likely to be existing sources of odour emissions. The East Site also has a small Sewage Treatment Works nearby, which will be a source of odour. The West Site is also close to the Port of Immingham and has some existing industrial facilities as neighbours, including the manufacture of building products. The West Site also has a household recycling centre nearby, which will be a source of odour.
A description of the location of receptors and their relative sensitivities to odour effects.	The nearest receptors to the East Site are the existing commercial and industrial land uses. These are considered to have a low sensitivity to odour impacts. The nearest receptors to the West Site are commercial properties on Queens Road. These are considered to have a low sensitivity to odour impacts. The nearest high sensitivity receptors are the residential properties, 350m to the west.
Details of potential odour sources and the resulting potential for generating odours.	Sources are limited to fugitive emissions of NH_3 from potential leaks and controlled emissions from flare stacks and vents. Emissions from leaks will be intermittent and short in duration. Emissions from flare stacks will be continuous, but the proportion of NH_3 is minimal.
A description of control/mitigation measures incorporated into the scheme (including management controls and, where appropriate, engineering controls).	The control of odour emissions will be secured by Environmental Permit. To control fugitive emissions, a leak detection management system will be in place, meaning that leaks can be identified and repaired quickly. The flares are used to combust any ammonia that would otherwise be released to atmosphere, thereby removing any odorous content from the emission. To control emissions from flare stacks, emissions are released from such a height that dispersion is encouraged and combustion temperatures are such that NH_3 emissions are minimised. To demonstrate good practice, which will likely be required by the Project's Environmental Permit, the operation of the Project will be subject to an Odour Management Plan. Such plan would: a. Set out additional odour control requirements beyond those embedded in the Project design. b. Establish best practice processes. c. Assign responsibilities, including record keeping. d. Set out the odour monitoring regime, including the frequency of sniff tests, the monitoring of meteorological

IAQM Guidance Criteria	Assessment of Project Conditions
	conditions, maintaining an odour diary and logging and investigating complaints.
A prediction of the likely odour impact and resulting effects at relevant sensitive receptors, and taking into account: a. The likely magnitude of odour emissions (after control by measures incorporated into the scheme, if applicable). b. The likely meteorological characteristics at the site. c. The dispersion and dilution afforded by the pathway to the receptors and the resulting magnitude of odour that could result. d. The sensitivity of the receptors. e. The potential cumulative odour effects with any odours of a similar character.	a. Wind rose plots from Humberside Airport over a five year period (see **Appendix 6.B [TR030008/APP/6.4]**) demonstrate the greatest frequency of winds blow from the southwest to the northeast across a narrow vector from 190º to 230º. Although winds do blow from all other directions at times during the year. b. Both the East Site and the West Site and surrounding area are reasonably flat with limited natural or artificial barriers. c. There is limited distance between the East Site and the West Site boundaries and the nearest odour sensitive receptors, although there will be some setback from potential odour emission sources. Over such distances there will be some potential for the dilution of emissions. d. The majority of receptors in close proximity to both the East Site and the West site are commercial or industrial land used with limited sensitivity to odour impacts. There nearest high sensitivity residential properties are 350m away off Kings Road. e. There are numerous cumulative sources of odour emissions in the area, although those existing sources are unlikely to be of a similar character.
Where odour effects are assessed as significant, details of appropriate further mitigation and control measures that could allow the proposal to proceed without causing significant loss of amenity.	Given the limited nature of emissions associated with the Project's operation and control measures incorporated into the Project design, a significant odour effect is considered to be unlikely and no further mitigation is considered necessary.
The residual odour impacts and their effects	Given the nature of the potential odour sources, the control measures incorporated into the Project design, and the commitment to review odour throughout the operational lifetime of the Project facility, the residual impacts considered not likely to contribute to a significant effect. The effect of odour is considered **Negligible** and **Not Significant**.

6.9 Mitigation and Enhancement Measures

6.9.1 The air quality assessment described in this chapter does not identify a significant air quality effect following the implementation of development design and impact avoidance (see **Section 6.8**).

6.9.2 No additional mitigation or enhancement measures are considered to be required.

6.10 Assessment of Residual Effects

6.10.1 Based on the implementation of the embedded and standard mitigation measures as detailed herein, the assessment of local air quality effects for the Project is summarised below.

Construction Phase

Construction Dust Emissions

6.10.2 Step 4 of the IAQM construction dust guidance (Ref 6-23) is to determine whether or not the effects, after the application of the identified level of mitigation are significant. The IAQM guidance states that:

"For almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'".

6.10.3 With the application of the embedded and standard practice mitigation measures, including those set out in the **Outline CEMP [TR030008/APP/6.4]** (see **Section 6.7**), the residual effect remains unchanged to that reported in **Section 6.8** and is **Not Significant**.

NRMM and Site Plant Emissions

6.10.4 According to the IAQM (Ref 6-23):

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur".

6.10.5 A review of site plant and NRMM has deemed that impacts are **not significant**, for the following reasons:

a. The transient and intermittent nature of emissions.

b. The limited number of emissions sources in operation per average day.

c. The distance between emission sources and the nearest high sensitivity receptors.

d. The effectiveness of standard practice emission control measures.

Construction Vessel Emissions

6.10.6 Construction vessel emissions have been considered in the same way as site plant and NRMM emissions. A review of construction vessel emissions has deemed that impacts are **not significant**, for the following reasons:

a. The transient and intermittent nature of emissions.

b. The number of vessel movements falls well below the number stipulated in Defra guidance (Ref 6-8) to represent a Local Air Quality Management concern.

c. The limited number of emissions sources.

d. The distance between emission sources and the nearest high sensitivity receptors.

Construction Road Traffic Emissions

6.10.7 Predicted construction phase traffic impacts have been considered at receptors adjacent to roads that exceed the relevant screening criteria set out in **Paragraph 6.4.17** or **Paragraph 6.4.18**. The screening exercise identified that roads on the route between the construction site entrance on Queens Road, to and from the A180 via the A1173, will exceed the local road screening criteria. No SRN road links will experience a traffic impact above the SRN screening criteria.

6.10.8 The impact of the Project's construction on local air quality, either in isolation or in-combination with the IERRT project is **not significant**.

Operational Phase

Operational Site and Vessel Emissions

6.10.9 Predicted operational phase emissions associated with site and vessel sources identified impacts on human health receptors as negligible. The effect of such an impact is **not significant**.

6.10.10 Predicted operational phase emissions from these sources identified impacts on nature conservation receptors of more than 1% of the Critical Level for NO_X and 1% of the Critical Load for nitrogen deposition at a limited number of sensitive receptor locations within the SAC. Impacts have been predicted based on vessel compliance with either MARPOL Tier III NO_X emission standards or MARPOL Tier II NO_X emissions standards. Whether or not these impacts constitute a significant effect is reported in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**.

Operational Road Traffic Emissions

6.10.11 The potential for operational phase traffic impacts has been considered by comparing changes in traffic flows against the screening criteria set out in **Paragraph 6.4.17** or **Paragraph 6.4.18**. This process identified that there are no roads that exceed the criteria relevant for local roads or relevant to roads on the SRN. Roads that experience the highest increase in traffic flow due to the operation of the Project do not have air quality sensitive receptors within 200m of them.

6.10.12 The impact of the operational traffic emissions on local air quality will not contribute to a significant effect. The effect of road traffic emission is **not significant**.

6.11 Summary of Assessment

6.11.1 A summary of the impact pathways that have been assessed, and the identified residual effects and level of confidence are presented in **Table 6-22.**

Table 6-22: Summary of potential impact, mitigation measures and residual effect

Receptor	Impact Pathway	Effect (unmitigated)	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Human health and amenity sensitive receptors	Construction dust emissions	Negligible to Low Not significant	Standard practice dust mitigation as recommended by the IAQM, outlined in **Section 6.7**	Negligible to Low Not significant	High – assessment based on industry standard guidance and precautionary assumptions
	Site Plant and NRMM emissions	Low Not significant	Standard practice mitigation as recommended by the IAQM, outlined in **Section 6.7**	Low Not significant	High – assessment based on industry standard guidance and precautionary assumptions
	Marine vessel emissions	Low Not significant	Good practice mitigation outlined in **Section 6.7**	Low Not significant	Medium – conclusion drawn on professional judgement informed by the number of construction vessels and the distance between those vessels and the nearest highly sensitive receptors
	Road traffic emissions	Negligible Not significant	Good practice mitigation outlined in **Section 6.7**	Negligible Not significant	High – detailed assessment following criteria provided in industry standard guidance and review of baseline air quality

Receptor	Impact Pathway	Effect (unmitigated)	Mitigation Measure	Residual Effect	Confidence
Nature conservation sensitive receptors	Construction dust emissions	Low Not significant	Standard practice dust mitigation as recommended by the IAQM, outlined in **Section 6.7**	Low Not significant	High – assessment based on industry standard guidance and precautionary assumptions
	Site Plant and NRMM emissions	Low Not significant	Standard practice mitigation as recommended by the IAQM, outlined in **Section 6.7**	Low Not significant	High – assessment based on industry standard guidance and precautionary assumptions
	Marine vessel emissions	Low Not significant	Good practice mitigation outlined in **Section 6.7**	Low Not significant	Medium – conclusion drawn on professional judgement informed by the number of construction vessels and the distance between those vessels and the nearest highly sensitive receptors
	Road traffic emissions	Negligible Not significant	Good practice mitigation outlined in **Section 6.7**	Negligible Not significant	High – detailed assessment screened following criteria provided in industry standard guidance
Operational Phase					
Human health and amenity sensitive receptors	Marine-side vessel and landside combustion and process emissions	Negligible Not significant	Good practice mitigation outlined in **Section 6.7**	Negligible Not significant	High – assessment based on industry standard guidance and

Receptor	Impact Pathway	Effect (unmitigated)	Mitigation Measure	Residual Effect	Confidence
					precautionary assumptions
	Road traffic emissions	Negligible Not significant	Good practice mitigation outlined in **Section 6.7**	Negligible Not significant	High – detailed assessment screened following criteria provided in industry standard guidance
	Odour emissions	Negligible Not significant	Standard practice odour mitigation as recommended by the IAQM, outlined in **Section 6.7**	Negligible Not significant	High – assessment based on industry standard guidance
Nature conservation sensitive receptors	Marine-side vessel and landside combustion and process emissions	Insignificant See **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**	Good practice mitigation outlined in **Section 6.7**	Insignificant See **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**	High – assessment based on industry standard guidance a
	Road traffic emissions	Negligible Not significant	Good practice mitigation outlined in **Section 6.7**	Negligible Not significant	High – detailed assessment screened following criteria provided in industry standard guidance

6.12 References

Ref 6-1 AEA Technology. (2008). Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedances of the 1-hour mean AQS Objective.

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 7: Noise and Vibration

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 7: Noise and Vibration

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

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Tables

7. Noise and Vibration

7.1 Introduction

7.1.1 This Chapter presents the findings of the assessment regarding the likely significant noise and vibration effects of the Project on human Noise Sensitive Receptors ("NSRs"). The Chapter also details the datasets used to inform the assessment, provides an overview of baseline conditions, and sets out how the likely significant effects have been assessed.

7.1.2 The potential noise effects on ecological receptors are assessed in the following Chapters **[TR030008/APP/6.2]**:

a. **Chapter 8: Nature Conservation (Terrestrial Ecology).**

b. **Chapter 9: Nature Conservation (Marine Ecology).**

7.1.3 The daily traffic flows from the transport assessment (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**) have been used in the road traffic noise assessment.

7.1.4 This Chapter is supported by the following figures and appendices:

a. **Figure 7.1: Sound Monitoring Locations [TR030008/APP/6.3]**.

b. **Appendix 7.A: Baseline Sound Survey [TR030008/APP/6.4]**.

c. **Appendix 7.B: Construction Sound Levels and Assumptions for landside construction works [TR030008/APP/6.4]**.

d. **Appendix 7.C: Operational Noise Information (Landside) [TR030008/APP/6.4].**

7.2 Consultation and Engagement

7.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the materials and waste assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on noise and vibration. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

7.2.2 The first period of Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

7.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. In light of these design changes, a second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

7.2.4 Both consultation events undertaken with statutory consultees to inform this Chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation events and other pre-application engagement are summarised in **Table 7-1**:. The full responses to consultation comments are included within the **Summary of Consultation Responses Document [TR030008/APP/5.1]**.

7.2.5 The Environmental Health Department at North East Lincolnshire Council ("NELC") was initially consulted via email on 14 April 2023 prior to undertaking additional baseline sound surveys. No response was received, and a follow up email was sent on 26 June 2023. The Environmental Protection Officer responded on 27 June 2023, a copy of which is included in **Table 7-1**:.

Table 7-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this Chapter
Scoping Report August 2022	Planning Inspectorate	Description: Construction and decommissioning vibration effects from the Work Area No. 7 on residential NSRs represented by NSR2 and NSR3 (now NSR 3 and NSR4 in this Chapter). The Scoping Report states that given the significant distance (over 450m) from the Work Area No. 7 to residential NSRs represented by NSR2 and NSR3 now NSR 3 and NSR4 in this Chapter) significant vibration effects are not expected to result from the proposed construction works (or decommissioning works) and seeks to scope out further assessment on these grounds. Given the distance from the Development Consent Order ("DCO") site boundary and these receptors, the Inspectorate agrees that this matter can be scoped out of the ES.	Noted - no response required.
		Description: Effects on residential NSRs due to noise and vibration from works in the Work Area No. 5 and at the new Jetty during construction and decommissioning. The Scoping Report proposes to scope out this matter owing to the large distance to identified sensitive receptors. As noted above, given the distance from the DCO site boundary and these receptors, the Inspectorate agrees that this matter can be scoped out of the Environmental Statement ("ES").	Noted. The changes to the design since the scoping assessment have been reviewed, including the addition of the concrete batching plant in Work Area No 5a during Phase 1 of construction. Due to the large distance to the nearest NSRs the impact will be negligible and can be scoped out. The potential vibration impacts on Immingham Oil Terminal ("IOT") during the piling operations for the marine works have been assessed in **Paragraph 7.9.26** to **Paragraph 7.9.34**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this Chapter
		Description: Effects on existing nearby buildings due to vibration from on-site operations during operation The Scoping Report states that no sources of vibration are expected that could significantly affect buildings, however the assessment would be scoped back in where such sources are identified during the EIA. The Inspectorate agrees that this matter can be scoped out of the ES providing a detailed description of the Proposed Development demonstrates that no significant effects from vibration sources from on-site operations would not have any significant effects.	There are no sources of vibration from the operation of the Project which could significantly affect buildings. The distance between Work Area 7 and the nearest NSRs is over 460m, therefore operational vibration impacts have been scoped out of this assessment as stated in **Paragraph 7.4.35.**
		Description: Potential Effects The Scoping Report refers broadly to "construction activities on-site" but it is not clear whether this includes noise associated with construction vessel movements. Construction vessel noise should be included as a pathway for effects within the assessment.	An assessment of traffic noise on the local highway network is included within **Paragraph 7.9.35**. However, given the large distance between residential receptors and the quayside (Work Area No.1) (~1.5 km) acknowledged in the second response above, and the nature of the sound of additional vessel movements being part of the established sound character of the area, it is considered unlikely that a significant effect would result and therefore an assessment of sea vessel noise is not required. A review of the number of vessel movements during construction is undertaken in **Paragraph 7.4.3**
	Environment Agency	Although written for environmental permitting, guidance entitled Noise and vibration management: environmental permits - GOV.UK (www.gov.uk) is not discussed in this Chapter, but will also be useful.	Noted. As stated in **Paragraph 7.8.11**, the hydrogen production facility will be operated in accordance with an Environmental Permit, issued and regulated by the Environment Agency.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this Chapter
	North East Lincolnshire Council	The proposed methodology for the assessment of both vibration and noise impact on nearest residential receptors is satisfactory.	Noted.
Statutory Consultation January 2023	Local Resident (living within approx. 10km of the project)	What noise will be made which may affect life in Immingham? Concern for noise at night-time disturbing sleep. Concern that the environmental effects of the project will only be known when it is too late.	**Section 7.9** of this Chapter presents an assessment of the impacts and effects of noise during the construction, operational and decommissioning phases of the Project on local NSRs, including the closest receptors in Immingham. The operational assessment in **Section 7.9** covers both daytime and night-time periods. Measures to avoid significant adverse effects, and minimise and mitigate other adverse effects at NSRs, in accordance with national noise policy, is presented in **Section 7.10** of this Chapter as appropriate.
	Local Resident (living within approx. 10 km of the project)	The new development will bring noise with the operational phase and contributed to an inhabited area which already suffers poor air quality.	**Section 7.9** of this Chapter presents an assessment of the impacts and effects of noise during the construction, operational and decommissioning phases of the Project on local NSRs, including the closest receptors in Immingham. The operational assessment in **Section 7.9** covers both daytime and night-time periods. Measures to avoid significant adverse effects, and minimise and mitigate other adverse effects at NSRs, in accordance with national noise policy, is presented in **Section 7.10** of this Chapter as appropriate. Potential air quality effects are covered in **Chapter 6: Air Quality [TR030008/APP/6.2]**.
	Local Resident (living within	Concern for increased dust and noise, especially traffic noise. Concern for the environment.	**Section 7.9** of this Chapter presents an assessment of the impacts and effects of noise during the construction, operational and decommissioning phases of the Project on local NSRs, including from project related road traffic. Measures to avoid significant adverse effects, and minimise

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this Chapter
	approx. 10 km of the project)		and mitigate other adverse effects at NSRs, in accordance with national noise policy, is presented in **Section 7.10** of this Chapter as appropriate. Potential dust effects are covered in **Chapter 6: Air Quality [TR030008/APP/6.2]**.
	Local Resident (sea angler who fishes in area)	Concern for predicted noise level increases in specific locations within Immingham. Would like more information related to noise levels during operation of plant and increased road transport.	**Section 7.9** of this Chapter presents assessment of the impacts and effects of noise during the construction, operational and decommissioning phases of the Project on local NSRs, including from project related road traffic. Measures to avoid significant adverse effects, and minimise and mitigate other adverse effects at NSRs, in accordance with national noise policy, is presented in **Section 7.10** of this Chapter as appropriate.
Statutory Consultation June 2023	Environmental Protection Officer, North East Lincolnshire Council	Reviewed the methodology, monitoring locations and measurement durations and find all to be satisfactory.	Noted. Details of the method, duration and locations of the baseline sound surveys are described in **Section 7.4** and **Appendix 7.A [TR030008/APP/6.4]**.

7.3 Legislation, Policy and Guidance

7.3.1 **Table 7-2** presents the legislation, policy and guidance relevant to the noise and vibration assessment and details how their requirements have been addressed in the assessment.

Table 7-2: Relevant legislation, policy and guidance regarding noise and vibration

Legislation/Policy/Guidance	Consideration within this ES Chapter
Environmental Noise (England) Regulations 2006 (Ref 7-19)	
The UK Government Environmental Noise (England) Regulations 2006 (as amended 2008, 2009, 2010) were introduced in England to implement European Union, Assessment and Management of Noise Directive 2002/49/EC (the "END") (The European Parliament and Council of the European Union, 2002). The aims of the END are to define a common approach in order to avoid, prevent or reduce the harmful effects of environmental noise. Under the END, strategic noise mapping of major roads, railways, airports and agglomerations has been completed across England and Round 3 results were published in 2019.	The location of Noise Important Areas ("NIA") defined under the END have been identified in **Paragraph 7.4.52** and referenced with respect to assessment of changes in road traffic noise.
Environmental Protection Act 1990 (Ref 7-20)	
The Environmental Protection Act 1990 ("EPA") Part 3 prescribes noise (and vibration) emitted from premises (including land) so as to be prejudicial to health or a nuisance as a statutory nuisance.	Reference is made in **Section 7.11** to the EPA with respect to operational noise control. A Statutory Nuisance Statement forms part of the DCO application **[TR030008/APP/7.5]**
Control of Pollution Act 1974 (Ref 7-6)	
Sections 60 and 61 of Control of Pollution Act 1974 ("CoPA") provide the principal legislation regarding demolition and construction site noise and vibration. If noise complaints are received by the local planning authority from local residents, a Section 60 notice may be issued by the local planning authority with instructions to cease work until specific conditions to reduce noise have been adopted. Section 61 of the CoPA 1974 provides a means for applying for prior consent to carry out noise generating activities during construction. Once prior consent has been agreed under Section 61, a Section 60 notice cannot be served provided the agreed conditions are maintained on-site. The CoPA requires that 'Best Practicable Means' (as defined in Section 72 of CoPA) be adopted for construction noise on any given site. CoPA makes reference to BS5228 as Best Practicable Means.	Reference is made in **Section 7.11** to the CoPA with respect to construction noise control.
Noise Policy Statement for England ("NPSE") (Ref 7-7)	
The NPSE (Ref 7-7) seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The	NPSE is considered in **Sections 7.3** and **7.9**

Legislation/Policy/Guidance	Consideration within this ES Chapter
NPSE (Ref 7-7) applies to all forms of noise, including environmental noise, neighbour noise and neighborhood noise. The statement sets out the long-term vision of the government's noise policy, which is to: a) "promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development". b) This long-term vision is supported by three aims: c) "avoid significant adverse impacts on health and quality of life; d) mitigate and minimise adverse impacts on health and quality of life; and e) where possible, contribute to the improvements of health and quality of life." The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society. The 'Explanatory Note' within the NPSE (Ref 7-7) provides further guidance on defining 'significant adverse effects' and 'adverse effects' using the concepts: a) No Observed Effect Level ("NOEL") - the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established; b) Lowest Observable Adverse Effect Level ("LOAEL") - the level above which adverse effects on health and quality of life can be detected; and c) Significant Observed Adverse Effect Level ("SOAEL") - the level above which significant adverse effects on 15 and quality of life occur. The three aims can therefore be interpreted as follows: a) the first aim is to avoid noise levels above the SOAEL; b) the second aim considers situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur; and c) the third aim seeks, where possible, to positively improve the health and quality of life through the pro-active management of noise whilst also taking account of the guiding principles of sustainable development. It is considered that the protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim. The NPSE (Ref 7-7) recognises that it is not possible to have uniform objective noise-based measures that define the SOAEL, LOAEL and NOEL that are applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, receptors and times of the day.	with respect to assessing significant adverse and other adverse noise effects and defining LOAELs and SOAELs for the different potential effect types.
National Policy Statement for Ports ("NPSfP") (Ref 7-8)	

The National Policy Statement for Ports ("NPSfP") (Ref 7-8) states in paragraph 5.10.4 to 5.10.7: 5.10.4 Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment: a) a description of the noise-generating aspects of the development proposal leading to noise impacts on the marine and terrestrial environment, including the identification of any distinctive tonal, impulsive or low-frequency characteristics of the noise; b) identification of noise-sensitive premises and areas and noise-sensitive species that may be affected; c) the characteristics of the existing marine and terrestrial noise environment; d) a prediction of how the noise environment will change with the proposed development: - in the shorter term during the construction period; - in the longer term during the operating life of the infrastructure; and - at particular times of the day, evening and night as appropriate. e) an assessment of the effect of predicted changes in the noise environment on any noise sensitive areas and noise sensitive species; and f) measures to be employed in mitigating the effects of noise. The nature and extent of the noise assessment should be proportionate to the likely noise impact. 5.10.5 The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should be considered 5.10.6 Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards. For the prediction, assessment and management of construction noise, reference should be made to any relevant British Standards which also give examples of mitigation strategies 5.10.7 The applicant should consult the Environment Agency and Natural England, or the Countryside Council for Wales, and the Marine Management Organisation in relation to marine protected species in England, as necessary and in particular with regard to assessment of noise on protected species or other wildlife. The results of any noise surveys and predictions may inform the ecological assessment. The seasonality of potentially affected species in nearby sites may also need to be taken into account. NPSfP paragraph 5.10.9 also repeats the aims given in the NPSE discussed above. It provides at paragraph 5.10.12 and 5.10.13 that: *"Mitigation measures for the project should be proportionate and reasonable and may include one or more of the following:* *a) engineering: reduction of noise at point of generation and containment of noise generated;*	A staged approach to assessing the operational noise has, therefore, been undertaken. Where potentially significant adverse effects have been identified based upon preliminary higher-level assessment, further, more detailed assessments have been undertaken. The assessments have been undertaken in accordance with the principles of the relevant British Standards and guidance documents as set out in **Section 7.3 and 7.4**. NPSfP provides further guidance on the approach to noise assessment, specifically related to port projects. **Section 7.9** of this Chapter provides a description of the noise generating aspects for both construction and operational phase. The NSRs are identified in **Section 7.7** of this Chapter. The noise sensitive species are assessed in **Chapter 8: Nature Conservation (Terrestrial Ecology)** and **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. The effects of the Project on human NSRs are assessed in **Section 7.7** of this Chapter and ecological receptors in **Chapter 8: Nature Conservation (Terrestrial Ecology)** and **Chapter 9: Nature Conservation (Marine**

Legislation/Policy/Guidance	Consideration within this ES Chapter
b) *lay-out: adequate distance between source and noise-sensitive receptors; incorporating good design to minimise noise transmission through screening by natural barriers or other buildings; and* c) *administrative: limiting operating times of source; restricting activities allowed on the site; specifying acceptable noise limits; and taking into account seasonality of wildlife in nearby designated sites.* *In certain situations, and only when other forms of mitigation have been exhausted, it may be appropriate for the decision maker to consider requiring noise mitigation through improved sound insulation to dwellings, or in extreme cases, compulsory purchase of affected properties, as a means of consenting otherwise unacceptable development."*	**Ecology) [TR030008/APP/6.2]**. The characteristic of the existing environment is taken into account in the construction and operational assessments in **Section 7.9** The mitigation measures are set out in **Sections 7.8** and **7.10.** The impact of ancillary operations (road traffic noise) is assessed in **Section 7.9.**
National Planning Policy Framework ("NPPF") (Ref 7-16)	
Whilst not the primary policy document for a Nationally Significant Infrastructure Project ("NSIP") Harbour development, the National Planning Policy Framework (NPPF) (Ref 7-16) contains policy on noise and vibration that has relevance to this Chapter. It sets out the Government's planning policies for England and how these are expected to be applied. The planning system is required to contribute to and enhance the natural and local environment. Consequently, the aim is to prevent both new and existing development from contributing to or being put at unacceptable risk from being adversely affected by unacceptable levels of noise pollution. The NPPF states in paragraph 185 that planning policies and decisions should: *"Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life"; and* *"identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason".*	Consideration has been given to NPPF as the overarching framework for mitigating the adverse and significant adverse effects of noise and vibration, and has been used in conjunction with NPSE and The Planning Practice Guidance for Noise ("PPG-N") to define the assessment approach as set out in **Section 7.4** of this Chapter.
Planning Practice Guidance – Noise (PPG-N) (Ref 7-15)	
The PPG-N (Ref 7-15) aims to make planning guidance more accessible, and to ensure that the guidance is kept up to date. The PPG was last updated for noise in July 2019. The guidance advises that local planning authorities should take account of the acoustic environment and consider: a) whether or not a significant adverse effect is occurring or likely to occur; b) whether or not an adverse effect is occurring or likely to occur; and c) whether or not a good standard of amenity can be achieved.	PPG-N has been referenced to provide supplementary guidance to NPPF with respect to mitigation of adverse and significant adverse effects of noise and vibration. As such it has been used to define the assessment approach as set out in **Section 7.4** of this Chapter**.**

Legislation/Policy/Guidance	Consideration within this ES Chapter
This guidance introduced the additional concepts of NOAEL (No Observed Adverse Effect Level), and UAEL (Unacceptable Adverse Effect Level). The NPSE and PPG recognise that it is not possible to have single objective noise-based measures that define the SOAEL, LOAEL and NOEL that is applicable to all sources of noise in all situations. The levels are likely to be different for different sound sources, receptors and at different times of the day. To determine appropriate LOAEL and SOAEL values in the context of the Project, reference has been made to methodologies and criteria presented in various British Standards and guidance documents. Factors to be considered in determining if noise is a concern are identified including the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative impacts. With particular regard to mitigating noise impacts on residential development, the guidance highlights that impacts may be partially offset if residents have access to a relatively quiet façade as part of their dwelling, or a relatively quiet amenity space (private, shared or public).	
Local Planning Policy - North East Lincolnshire Local Development Plan 2013 to 2032 (adopted 2018) (Ref 7-17)	
The North East Lincolnshire Local Plan ("LP") (2013 to 2032) was adopted in 2018 and sets out a strategic vision for the area. The plan is centred around set challenges for NELC and policy which has been implemented to solve them and support local economic sectors. Paragraph 6.38 of the LP states: *"The Borough's economy is heavily reliant on good rail and road freight links, along with sea traffic. The LTP3 outlines a number of freight transport related issues, which have a direct bearing on the Borough's economic performance:* *1. local access to sites such as ports, affecting their day-to-day operations;* *2. transit routes that affect communities through high levels of HGV traffic and the severance, noise and pollution this can bring;* *3. access to main trunk routes, especially the motorway network;* *4. capacity constraints some distance from the area, such as constraints on the M1, A1 and East Coast Mainline; and,* *5. rail freight capacity in terms of train paths, line speeds and height restrictions."* Policy 5 of the LP states: *" Policy 5 – Development boundaries* *1. Development boundaries are identified on the Policies Map. All development proposals located within or outside of the defined boundaries will be considered with regard to suitability and sustainability, having regard to:*	Local planning policies have been reviewed to ensure the assessment approach set out in **Section 7.4** of this Chapter incorporates consideration of local authority requirements.

Legislation/Policy/Guidance	Consideration within this ES Chapter
D. impact upon neighbouring land uses by reason of noise, air quality, disturbance or visual intrusion"	
Local Planning Policy - North Lincolnshire Council Planning for Health and Wellbeing- Supplementary Planning Document (November 2016) (Ref 7-18)	
The NLC Planning for Health and Wellbeing - Supplementary planning document was adopted in July 2016. It builds on policies in the Core Strategy and North Lincolnshire Local Plan and sets out our planning policy towards Health and Wellbeing and is used to make decisions on planning applications. Policy 3 – Well designed places states that when considering the detail of development, proposals should: *"Seek to reduce noise and air pollution through ensuring planning applications include a Noise Impact Assessment and Air Quality Assessment in areas of concern."* Paragraph 4.15 states "the design of places also needs to take account of transport which has a direct impact on health and safety. Air pollution, noise, traffic and congestion all have a negative impact on people's ability to enjoy their environment."	Local planning policies are reviewed to ensure the assessment approach set out in **Section 7.4** incorporates consideration of local authority requirements.

7.4 Assessment Methodology

Construction Phase Impacts

7.4.1 To determine the potential temporary noise and vibration impacts that may arise during the construction phase of the Project, the following matters have been considered:

a. Noise and vibration caused by construction of Work Area No. 7 activities.

b. Noise caused by increases in traffic on the existing highway network, as a result of construction traffic.

7.4.2 Vibration from traffic on the highway network during the construction phase has been scoped out. Former DMRB document HD 213/11 Rev 1 (Ref 7-24) reports that extensive research on a wide range of buildings found no evidence of traffic induced ground borne vibration being a source of significant damage to buildings and no evidence that exposure to airborne vibration has caused even minor damage. It was also stated that perceptible vibration only occurs in rare cases and identifies that the normal use of a building, such as closing doors and operating domestic appliances, can generate similar levels of vibration to that from traffic in most circumstances.

7.4.3 As detailed in **Chapter 2: The Project [TR030008/APP/6.2]**, a small number of sea vessel movements will be required during the construction phase. In particular, the ammonia storage tank is likely to be transported in large sections to site via sea vessel, before being transported within the Port to Work Area No. 5 for installation.

7.4.4 However, given the large distance between the nearest residential NSRs on Queens Road and the quayside (Work Area No. 1, ~1.5km), and the nature of the sound of a small number of additional vessel movements in an area where this source is an established part of the sound character of the area, it is considered unlikely that additional sea vessel noise would be perceptible and therefore a significant effect is considered unlikely. As a result, noise from sea vessel movements has been scoped out of this assessment.

Noise from Construction Sites

7.4.5 The potential noise impacts arising from construction activities for Work Area No. 7 have been assessed using the data and procedures given in BS 5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (Ref 7-2). Details of the construction plant and assumptions used for the construction assessment for the landside works can be found in **Appendix 7.B Construction Noise Information [TR030008/APP/6.4]**.

7.4.6 The assessment involves the calculation of sound emissions from the construction site based on the sound power levels associated with the plant or equipment to be used, and the propagation from sound source to the NSR locations. Sound power levels are taken from manufacturers data and/or archive data given in BS 5228 Part 1. The calculated levels are then compared to nominated criteria to determine whether an adverse impact is expected.

7.4.7 For residential NSRs, the 'ABC' method (detailed in BS 5228 Part 1 Section E.3.2) sets construction noise thresholds for residential NSRs for different time periods (e.g. day, evening, night and weekends) based on the existing ambient noise levels. For the appropriate period (day, evening, night, weekend etc.), the existing ambient noise level is determined and rounded to the nearest 5 dB and the appropriate threshold value is then derived. The predicted construction noise level is then compared with this construction noise threshold value.

7.4.8 The ABC method has then been used as a basis to define criteria that constitutes a potential significant effect at residential receptors. The ABC method is reproduced in **Table 7-3**.

Table 7-3: Construction noise thresholds at residential dwellings

Assessment category and threshold value period	Threshold value $L_{Aeq,T}$ dB – free-field		
	Category A (a)	Category B (b)	Category C (c)
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Assessment category and threshold value period	Threshold value $L_{Aeq,T}$ dB – free-field		
	Category A (a)	Category B (b)	Category C (c)
NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. NOTE 3: Applies to residential receptors only.			
(a) Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. (b) Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values. (c) Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. (d) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.			

7.4.9 Based upon the BS 5228 ABC method (Ref 7-2), the criterion adopted for the determination of potentially significant effects is the exceedance of the $L_{Aeq,T}$ threshold level for the category appropriate to the ambient noise level at each NSR. This is considered to be equivalent to the SOAEL, although as stated in BS 5228, other project-specific factors, such as the number of NSRs affected and the duration and character of the impact, should also be considered by the assessor when determining if there is a potentially significant effect.

7.4.10 For residential receptors and other high sensitivity human receptors, the criterion for the LOAEL – see **Table 7-2** for further details - is a predicted construction noise level equal to the existing ambient noise level at each NSR i.e. resulting in a 3 dB increase in noise level when combined with the existing ambient noise level (decibels are measured on a logarithmic scale so noise levels cannot be summed arithmetically – two sounds of equal level combine to raise the overall sound level by 3 dB).

7.4.11 In accordance with planning policy, significant adverse effects (at or above the SOAEL) should be avoided and other adverse effects (at or above the LOAEL) should be mitigated and minimised, where possible. The assessment focuses on the effects at the nearest existing residential NSRs on Queens Road and the eastern edge of Immingham's main urban residential area to the west (the closest NSRs to the works). If adverse effects can be avoided at these NSRs, the effects will be less at greater distances.

7.4.12 Based on the above, the magnitude of construction noise impacts on residential receptors has been classified in accordance with the criteria in **Table 7-4**.

Table 7-4: Construction noise magnitude of impact for residential receptors

Magnitude of Impact	Comparison with Threshold Value $L_{Aeq,T}$ dB
High	Exceedance of ABC Threshold Value (the SOAEL) by ≥+5 dB
Medium	Exceedance of ABC Threshold Value (the SOAEL) by up to +5 dB
Low	Equal to or below the ABC Threshold Value (the SOAEL) by up to -5 dB
Very Low	Below the ABC Threshold Value (the SOAEL) by ≥-5 dB

7.4.13 A quantitative assessment of construction noise has been undertaken to identify potentially significant effects and this has been based upon the available information regarding construction activities and plant requirements.

Noise from construction traffic on existing roads

7.4.14 The noise impacts of construction traffic along existing roads have been assessed with reference to the National Highways document DMRB LA111 (Ref 7-12).

7.4.15 The change in noise level for relevant road links is predicted based on the Calculation of Road Traffic Noise ("CRTN") (Ref 7-9) Basic Noise Level ("BNL") methodology.

7.4.16 The relevant links assessed represent the relevant highway routes that would be taken by Project construction traffic between the Site and the A180. Noise impacts along the construction traffic routes are considered only where there are NSRs along those routes.

7.4.17 BNL predictions have been undertaken for both "with" and "without" construction traffic scenarios for each road link expected to be used by construction vehicles, using daily traffic flows from the transport assessment (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**).

7.4.18 The criteria for the assessment of traffic noise changes arising from construction road traffic are taken from Table 3.17 of DMRB LA111 (Ref 7-12) as reproduced in **Table 7-5**. Magnitude of impact descriptors corresponding to the terminology used in this impact assessment methodology are provided in parenthesis where they differ from DMRB terminology.

Table 7-5: Magnitude of impact at noise sensitive receptors from construction traffic

Magnitude of impact	Change in traffic noise level $L_{A10,18h}$ dB
Major (High)	≥ 5
Moderate (Medium)	3 to <5
Minor (Low)	1 to <3
Negligible (Very Low)	<1

Construction vibration impacts on humans - annoyance

7.4.19 Vibration due to construction activities has the potential to result in adverse impacts at nearby human receptors. The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receptor and the activities being undertaken. BS 5228-2: 2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites - Vibration' (Ref 7-2) provides data on measured levels of vibration for various construction works, with particular emphasis on piling. Impacts are considered for both damage to buildings/structures and annoyance to occupiers.

7.4.20 Table E.1 of BS 5228-2 contains a general method for calculation of Peak Particle Velocity ("PPV") from percussive piling. This method is designed for use on any percussive piling with limited consideration of ground conditions so risks producing exaggerated worst-case levels. For the landside piling in Work Area No.7, Work Area No.5 and Work Area No.3, pile design is not yet complete, but a low noise approach to terrestrial piling, such as the use of bored or cast in situ piles, would be adopted to minimise noise and vibration during piling activities. The final piling method will be determined once the contractor has been appointed and will be confirmed in the final CEMP.

7.4.21 **Table 7-6** sets out PPV vibration levels and provides a semantic scale for the description of demolition and construction vibration impacts on human receptors, based on guidance contained in BS 5228-2, for reference where assessment of construction vibration impacts on human receptors is required.

Table 7-6: Construction vibration threshold at residential dwellings

Peak Particle Velocity (PPV) level	Description	Magnitude of impact
>= 10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High
1.0 to < 10 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	Medium

Peak Particle Velocity (PPV) level	Description	Magnitude of impact
0.3 to < 1.0 mm/s	Vibration might be just perceptible in residential environments.	Low
0.14 to < 0.3 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Very low

7.4.22 For residential receptors, the LOAEL is defined as a PPV of 0.3 mm/s (millimetres per second); this being the point at which construction vibration is likely to become perceptible. The SOAEL is defined as a PPV of 1.0 mm/s, this being the level at which construction vibration can be tolerated with prior warning.

7.4.23 At receptors above the SOAEL, further consideration of whether an effect is significant has been undertaken using professional judgement, taking account of the duration and frequency of the effect, as well as the time of day/evening/night that the effect would be experienced.

7.4.24 Given the significant distance from Work Area No. 7 to residential NSRs represented by NSR3 and NSR 4 (NSR 2 and NSR 3 in the scoping report) (see **Table 7-11**) significant vibration effects are not expected to result from the proposed construction or decommissioning activities associated with the Project, as acknowledged in the Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4])**, and therefore further assessment is scoped out.

Construction vibration impacts on buildings and structures

7.4.25 Buildings and structures may be damaged by high levels of vibration. The closest point between the existing NSRs and the Site is approximately 16 m and therefore there is the potential for significant effects depending upon the construction works required in the vicinity of existing buildings.

7.4.26 The principal concern is generally transient vibration, for example due to piling or significant earthworks such as ground compaction.

7.4.27 BS 7385-2: 1993 ‘Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration’ (Ref 7-22) provides guidance on vibration levels likely to result in cosmetic damage and is referenced in BS 5228-2: 2009+A1:2014 (Ref 7-2, Ref 7-3). Guide values for transient vibration, above which cosmetic damage could occur, are given in **Table 7-7**.

Table 7-7: Transient vibration guide values for cosmetic damage

Peak Particle Velocity (PPV) level	Description Magnitude of impact	
	4 Hz to 15Hz	15 Hz and Above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Values referred to are at the base of the building
Note 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

7.4.28 Percussive impact piling is classed as transient vibration as it comprises of discreet individual events. BS 7385-2 (Ref 7-22) states that the probability of building damage tends to be zero for transient vibration levels less than 12.5 mm/s PPV. For continuous vibration, such as from vibratory rollers, the threshold is around half this value.

7.4.29 It is noted that these values refer to the likelihood of cosmetic damage. ISO 4866:2010 (Ref 7-23) defines three different categories of building damage:

a. Cosmetic – formation of hairline cracks in plaster or drywall surfaces and in mortar joints of brick/concrete block constructions.

b. Minor – formation of large cracks or loosening and falling of plaster or drywall surfaces or cracks through brick/block.

c. Major – damage to structural elements, cracks in support columns, loosening of joints, splaying of masonry cracks.

7.4.30 BS 7385-2:1993 (Ref 7-22) defines that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration level twice that of minor damage. Therefore, this guidance can be used to define the magnitude of impact identified in **Table 7-8** for both transient and continuous vibration.

Table 7-8: Magnitude of impact – construction vibration building damage

Magnitude of Impact	Damage Risk	Continuous Vibration Level PPV mm/s		Transient Vibration Level PPV mm/s	
		Unreinforced or light framed structures	Reinforced or framed structures	Unreinforced or light framed structures	Reinforced or framed structures
High	Major	≥30	≥100	≥60	≥200
Medium	Minor	15 to <30	50 to <100	30 to <60	100 to <200
Low	Cosmetic	6 to <15	25 to <50	12 to <30	50 to <100
Very low	Negligible	<6	<25	<12	<50

7.4.31 These values for construction vibration building damage are applied within this Chapter where activities of a significant vibration producing nature are likely to be required at the development site during construction.

Operational Phase Impacts

7.4.32 To determine the potential noise and vibration impacts that may arise during the operational phase of the Project, the following matters have been considered:

a. Noise from mechanical plant associated with the Work Area No. 3, Work Area No. 5 Area and Work Area No. 7.

b. Noise from traffic movements on the local highways associated with export of liquified hydrogen product.

7.4.33 As stated in **Chapter 2: The Project [TR030008/APP/6.2]**, as a worst case there will be 292 vessel movements per year. However, given the large distance between the nearest residential NSRs in Immingham and the quayside (~2.5km), and the nature of the sound of a small number of additional vessel movements in an area where this source is an established part of the sound character of the area, it is considered unlikely that additional sea vessel noise would be perceptible and therefore a significant effect is considered unlikely.

7.4.34 Due to the low number (approximately four an hour) of HGV movements over a 24 hour period and typical noise levels produced by tanker filling operations on-site, the predictions for Heavy Goods vehicles (“HGV”) movements operating within the site have been excluded from the operational noise assessment due to the negligible impact on the overall operational noise level.

7.4.35 There are no sources of vibration from the operation of the Project which could significantly affect buildings, this includes both vibrations from operational plant on site and vibrations from on-site traffic movements. The distance between the Work Area No. 7 and the nearest NSRs is over 460m, therefore operational vibration impacts have been scoped out of this assessment.

Noise from operation of the Project (on-site sound sources)

7.4.36 Noise emissions from the operation of the Project have been predicted using CadnaA® noise modelling software which implements the calculation procedures of ISO 9613 'Acoustics – Attenuation of Sound During Propagation Outdoors', (Ref 7-14) (as appropriate), and based upon information regarding the operating conditions and levels of sound generated by the mechanical and process plant on-site.

7.4.37 The assessment has been undertaken using BS 4142 (Ref 7-5) but a combination of methods, depending upon the applicability of the method relative to the sound source, have been used, as set out below.

BS 4142

7.4.38 An assessment of potential noise impact at nearby NSRs has been undertaken, where applicable, using the guidance in BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 7-5).

7.4.39 A key aspect of the BS 4142 (Ref 7-5) assessment procedure is a comparison between the *background sound level* in the vicinity of residential locations and the rating level of the sound source under consideration. The relevant parameters in this instance are as follows:

a. *Background sound level – $L_{A90,T}$* – defined in the Standard as the *"A-weighted sound pressure level that is exceeded by the residual sound for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels"*;

b. *Specific sound level – L_s ($L_{Aeq,Tr}$)* – the "*equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr"*; *and*

c. *Rating level – $L_{Ar,Tr}$* – the *"specific sound level plus any adjustment made for the characteristic features of the sound"*.

7.4.40 BS 4142 (Ref 7-5) allows for corrections to be applied based upon the presence or expected presence of the following:

a. *Tonality: up to +6 dB penalty* (ranging between a sound that is not tonal and one that is prominently tonal (i.e. containing a discreet frequency/frequency band), at the NSR location).

b. *Impulsivity: up to +9 dB penalty* (ranging between a sound that has no impulsive character and one that is highly impulsive (i.e. containing short pulses of high frequency components), at the NSR location) (this can be summed with tonality penalty).

c. *Other sound characteristics (neither tonal nor impulsive but still distinctive): +3 dB penalty.*

7.4.41 Once any adjustments have been made, the background sound level and the rating level are compared. The standard states that:

a. *"Typically, the greater the difference, the greater the magnitude of impact.*

b. *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*

c. *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*

d. *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

7.4.42 Importantly, the context of the surrounding sound environment has been taken into consideration, as required by BS 4142 (Ref 7-5) when defining the overall significance of the impact.

7.4.43 Based on BS 4142 (Ref 7-5) guidance a one-hour assessment period during the day and a 15-minute assessment period at night has been used in this assessment.

7.4.44 **Table 7-9** illustrates the magnitude of impact scale to be used in the EIA based upon the numerical level difference. For BS 4142 (Ref 7-5) assessment purposes, the SOAEL is set at a rating level above the *background sound level* of +10 dB, and the LOAEL at +5 dB, although it should be remembered that the context assessment (including the absolute level of the sound under consideration) can vary the overall classification of effects.

Table 7-9: Magnitude of impact for industrial sound

Magnitude of impact	BS 4142 descriptor	*Rating level* **minus** *background sound level* **(dB)**
High	No BS 4142 descriptor for this magnitude level	>15
Medium	Indication of a significant adverse impact, depending upon context	+10 approx.
Low	Indication of an adverse impact, depending upon context	+ 5 approx.
Very low	Indication of low impact, depending upon context	≤ 0

IEMA 'Guidelines for Environmental Noise Impact Assessment'

7.4.45 The Institute of Environmental Management and Assessment's ("IEMA") 'Guidelines for Environmental Noise Impact Assessment' (Ref 7-13) have been used to assess the impact of changes in ambient sound level at NSRs due to the operation of the Project. On the impact of noise level changes, paragraph 2.7 of the guidelines state:

"For broad band sounds which are very similar in all but magnitude, a change or difference in noise level of 1 dB is just perceptible under laboratory conditions, 3 dB is perceptible under most normal conditions, and a 10 dB increase generally appears to be twice as loud. These broad principles may not apply where the change in noise level is due to the introduction of a noise with different frequency and/or temporal characteristics compared to sounds making up the existing noise climate. In which case, changes of less than 1 dB may be perceptible under some circumstances."

7.4.46 The IEMA Guidelines (Ref 7-13) provide criteria for the magnitude of impacts due to noise level changes from a project, as shown in **Table 7-10**, and these have been used within the assessment.

Table 7-10: Categorising the magnitude of the noise change

Magnitude of Impact	Noise Change, dB
No change	0
Low	0.1 to 2.9
Medium	3 to 4.9
High	>5

Noise from operation of the Project (road traffic noise)

7.4.47 An assessment of noise from road traffic during the operational phase of the Project has been undertaken using guidance provided in DMRB LA 111 (Ref 7-12), as set out earlier under the subsection "Noise from construction traffic on existing roads."

Data and information sources

7.4.48 Baseline sound monitoring survey results (see **Section 7.7**) have been used to characterise the sound climate at the nearest NSRs to the Site Boundary. The sound survey data have been supplemented by a desk-based review of other available baseline information. The main desk-based sources of information that have been reviewed to assist in determining the baseline environment within the vicinity of the Site include:

a. Satellite imagery (Google Maps)

b. Ordnance Survey ("OS") mapping.

c. UK environmental noise mapping undertaken as per the requirements of the Environmental Noise Directive ("END") Directive (Ref 7-10) viewed on Extrium England Noise and Air Quality Viewer (Ref 7-11).

7.4.49 The following sources of information have been reviewed and inform the assessment of likely significant effects of noise and vibration generated by the Project:

a. Baseline sound monitoring surveys results.

b. Construction plant and equipment data from similar installations.

c. Construction noise data referenced in BS 5228 2009+A1:2014: 'Noise and Vibration Control on Construction and Open Sites – Part 1: Noise' (Ref 7-2).

d. Works plans (**Figure 2.3 [TR030008/APP/6.3]**).

e. Operational on-site plant and equipment data sound power level data from similar installations.

f. OS mapping and aerial photography of the Site and surrounding area.

g. Visit to the area around the Site Boundary.

h. Project description and construction information in **Chapter 2: The Project ([TR030008/APP/6.2]**).

i. Construction traffic flow data from the transport assessment (see **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**).

Determining baseline conditions and noise and vibration sensitive receptors

7.4.50 The location of potential NSRs in proximity to the Site Boundary has been considered when assessing the effects associated with noise and vibration levels from the construction, operational (including maintenance) and decommissioning phases of the Project.

7.4.51 Key NSR locations which are considered representative of the nearest and potentially most sensitive existing receptors to the Site have been identified, based upon knowledge of the local area and professional judgement. It is considered that if noise and vibration levels are suitably controlled at these receptors, then noise and vibration levels will be suitably controlled at other sensitive receptors in the surrounding area, but which are more distant. The NSRs are described in **Table 7-11** and illustrated **on Figure 7.1 [TR030008/APP/6.4]**. The classification of sensitivity is taken from **Table 7-12**.

Table 7-11: Representative noise sensitive receptors

Description	Sensitivity/ value of receptors	Distance and Direction from the Site Boundary (m)
Residential properties between 1-31 Queens Road. Two representative receptors have been selected as follows: - 31 Queens Road, l(“**NSR1”)** and represents other NSRs at eastern end of row of properties - 1 Queens Road, (“**NSR2”)** and represents other NSRs at western end of row of properties (Note: not all premises on Queens Road are residential NSRs as these premises also include business uses, which are classified as lower sensitivity – see **Table 7-12**)	High	Within the Work Area No. 7, immediately adjacent to the western Site Boundary

Description	Sensitivity/ value of receptors	Distance and Direction from the Site Boundary (m)
NSR1 and NSR2 are only being considered during the construction phase as they will not be occupied during the operational phase as explained in **Chapter 2: The Project** (**[TR030008/APP/6.2]**).		
Residential properties at Chestnut Avenue, Waterworks Street and Spring Street (eastern extent of Immingham's residential urban area) Properties in this area are grouped together with the above and later referred to as **NSR3** for the purpose of this assessment.	High	480m north-west of the Site Boundary
Residential properties at Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk, Talbot Road and Kendal Road (eastern extent of Immingham's residential urban area) Properties in this area are later referred to as **NSR4** for the purpose of this assessment.	High	460 m west of the Site Boundary

7.4.52 NIAs are those areas identified through strategic UK environmental noise mapping (Ref 7-11) where the top 1% of the population are affected by the highest noise levels in England. The nearest NIA is located in Great Coates on the A1136 around the junction with Aylesby Road. This is approximately 5.6km from the Site Boundary and beyond the study area (as set out in **Section 7.6**) over which noise effects are considered likely - noise impacts from the Project at this location are unlikely.

7.4.53 A description of the study areas for ecological receptors is presented in **Chapter 8: Nature Conservation (Terrestrial Ecology)** and **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** which describe the key noise sensitive ecological receptors and presents an assessment of noise impacts on those receptors as relevant.

Baseline sound data collection

7.4.54 In order to help define existing sound conditions at these NSRs, ambient sound measurements have been undertaken following the requirements of BS 7445 1: 2003 'Description and measurement of environmental noise. Guide to quantities and procedures' (Ref 7-1), in particular regarding instrumentation and monitoring methodology. Attended sound measurements surveys were undertaken in October 2022 at two representative residential locations in the vicinity of the Site Boundary, as follows:

a. **ML1** – outside 31 Queens Road, Immingham (representing NSR1 at the eastern end of Queens Road).

b. **ML2** – on land off Worsley Road (representing NSR4 on the eastern edge of Immingham).

7.4.55 In addition, unattended sound measurements surveys were undertaken in April 2023 at two further representative residential locations in the vicinity of the Site to supplement the attended monitoring which was undertaken in October 2022. The unattended sound monitoring locations are as follows:

a. **ML3** – inside garden of 17 Spring Street, Immingham (representing NSR3 on the eastern edge of Immingham).

b. **ML4** – inside garden of 29 Talbot Road, Immingham (representing NSR4 on the eastern edge of Immingham).

7.4.56 All monitoring locations are presented on **Figure 7.1 [TR030008/APP/6.3]**. The surveys at ML1 and ML2 included a minimum of one-hour measurements during the daytime (between the hours 07:00 to 23:00) and 30-minutes during the night-time (between the hours of 23:00 to 07:00). The surveys at ML3 and ML4 included a minimum of seven days of baseline sound level data collection. Each sound level meter was set to log the L_{AF10}, L_{Aeq}, L_{AF90} and L_{AFmax} parameters.

7.4.57 All measurements were taken at approximately 1.4 m above ground level and were positioned at least 3.5m from any reflecting surface, other than the ground (i.e. free-field). Details of ongoing activities and noise sources in the area were recorded whilst in attendance at the monitoring locations and around the Site.

7.4.58 The weather conditions during the attended survey periods were all within the parameters set out in the relevant guidance documents including BS 7445 (Ref 7-1) and BS 5228-1 (Ref 7-2). During the unattended survey period, some meteorological conditions fell outside the acceptable range and therefore baseline data collected at these times have been excluded from use in this assessment.

7.4.59 The sound level meters and associated microphones were field calibrated at the beginning and end of their respective measurement periods in accordance with recommended practice. No significant drift in calibration was observed. The accuracy of the calibrator can be traced to the National Physical Laboratory Standards.

7.4.60 Details of the survey locations, equipment used and conditions recorded within the Site Boundary can be found in **Appendix 7.A Baseline Sound Survey [TR030008/APP/6.4]**.

7.4.61 In addition to the baseline surveys undertaken in April 2023 and October 2022 for the Project, baseline data was collected during 2021-22 for the Applicant's separate 'Immingham Eastern Ro-Ro Terminal' ("IERRT") project (on Port land to the east and north of the Site Boundary). The attended monitoring for IERRT was undertaken over a 24 hour period and is used in this assessment as additional baseline sound data to determine construction noise thresholds for NSRs on Queens Road. The sound monitoring location of relevance to this Project is:

a. **I_ML5 –** opposite Queens Road Café, Queens Road, Immingham (referred to as location M2 in IERRT Environmental Statement and representing the western end of Queens Road NSR2).

Defining Significance of Effect

Sensitivity/value of receptors

7.4.62 Noise and vibration effects have been classified based on the relevant magnitude of the impact (as outlined above for the various potential impacts during construction, operation and decommissioning) and the sensitivity or value of the affected receptor. The scale of receptor sensitivity presented in **Table 7-12** has been based on professional judgement and classifications adopted for other recent EIAs for DCO applications.

Table 7-12: Sensitivity/value of receptors

Sensitivity/ Value of Resource/ Receptor	Description	Example of Receptor Usage
Very high	Receptors where noise or vibration will significantly affect the function of a receptor	a. Auditoria/studios. b. Specialist medical/teaching centres, or laboratories with highly sensitive equipment.
High	Receptors where people or operations are particularly susceptible to noise or vibration	a. Residential. b. Quiet outdoor areas used for recreation. c. Conference facilities. d. Schools/educational facilities in the daytime. e. Hospitals/residential care homes. f. Libraries.
Medium	Receptors moderately sensitive to noise or vibration where it may cause some distraction or disturbance	a. Offices. b. Restaurants/retail. c. Sports grounds when spectator or noise is not a normal part of the sports event and where quiet conditions are necessary (e.g.: tennis, golf).
Low	Receptors where distraction or disturbance of people from noise or vibration is minimal	a. Residences and other buildings not occupied during working hours. b. Factories and working environments with existing high noise levels. c. Sports grounds when spectator or noise is a normal part of the sports event.

Classification of effects

7.4.63 Impacts are defined as changes arising from the Project, and consideration of the result of these impacts on environmental receptors enables the identification of associated effects, and their classification (major, moderate, minor and negligible, and adverse, neutral or beneficial). Each effect has been classified after embedded and standard mitigation measures have been applied. The residual effects are then assessed after additional mitigation (if required) has been applied as set out in **Chapter 5: The EIA Process [TR030008/APP/6.4]**.

7.4.64 The following terminology has been used in the assessment to define effects:

a. Adverse – detrimental or negative effects to an environmental resource or receptor.

b. Neutral – effects to an environmental resource or receptor that are neither adverse nor beneficial.

c. Beneficial – advantageous or positive effect to an environmental resource or receptor.

7.4.65 The effect resulting from each individual potential impact type detailed above has been classified according to the relevant magnitude of the impact and the sensitivity or value of the affected receptor using the matrix presented in **Table 7-13**. Where necessary the context of the acoustic environment has also been considered in determining the classification of effect.

Table 7-13: Classification of effects

Sensitivity/Value of Resource/Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very high	Major	Major	Moderate	Minor
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

7.4.66 Where adverse or beneficial effects are identified, these have been assessed against the following significance scale, derived using the matrix presented in **Table 7-13**:

a. Negligible – imperceptible effect of no significant consequence.

b. Minor – slight, very short or highly localised effect of no significant consequence.

c. Moderate – limited effect (by extent, duration or magnitude), which may be considered significant.

d. Major – considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

7.4.67 For the purposes of this assessment, negligible and minor effects are considered to be not significant, whereas moderate and major effects are considered to be significant. Where necessary, the context of the existing acoustic environment has also been taken into account in determining the classification of effect.

7.5 Limitations and Assumptions

Applicable to all Project Phases

7.5.1 The information presented in this assessment is based on the Works plans (**Figure 2.3 [TR030008/APP/6.3])** for the Project and the maximum likely extents of land required for its construction and operation, and subsequent decommissioning (of the hydrogen production facilities and the jetty topside infrastructure) within each work plan.

7.5.2 The construction and operational traffic noise assessment is based on the 18 hour Average Annual Weekday Traffic (AAWT) data provided by the traffic team. The vehicle speeds have been based on the speed limit of the roads.

Operation

7.5.3 A 'reasonable worst case' operational layout has been assessed which is defined as follows:

a. The operational layout of Work No. 7 ('West Site') and Work No. 5 ('East Site') are configured such that the noisiest possible configuration of Hydrogen Production Units ("HPUs") and Hydrogen Liquefiers has been assessed, in the context of the NSRs at the eastern edge of Immingham to the west. The HPUs are noisier and this configuration therefore assumes a HPU at the western edge of Work Area 7b. This is also the case for Work No. 7a, where two HPUs are placed at the western edge of the Work Area boundary.

b. The HPUs and Hydrogen Liquefiers are themselves comprised of a number of individual plant elements, some of which generate noise. The items of plant are spatially separated as determined by their process function. The assessment assumes the noisiest possible configuration for an individual HPU or Hydrogen Liquefier in the context of the NSRs at the eastern edge of Immingham. The noisiest plant element is the Flue Stack (ID Fan) for a HPU and the Two N2 Companders for a Hydrogen Liquefier.

c. This approach means that in future a different configuration could be brought forward and the noise effects at the NSRs on the Eastern edge of Immingham would be no worse than that assessed in the ES.

7.5.4 Details of the operational plant and noise modelling assumptions can be found in **Appendix 7.C Operational Noise Information [TR030008/APP/6.4]**. The operational assessment has assumed that operational plant with potential sound of a tonal, impulsive or intermittent nature (according to BS4142: 2014) will be designed out of the Project during the detailed design phase.

Construction

7.5.5 The final construction methods and plant requirements will not be available until the construction contractor is appointed. The construction noise assessment, whilst quantitative, is based primarily on construction plant which is likely to be used, and professional judgement and is therefore considered robust.

7.5.6 The construction noise assessment has been carried out assuming the construction plant are operating in Work Area No. 7 are located at the realistic closest approach to the NSRs. Therefore, this is a realistic worst-case scenario, as not all the plant will be at the realistic closest approach for the full duration, and the construction plant is likely to spread across the Work Area No.7. Construction noise thresholds (limit values) are based upon existing ambient sound levels at NSRs. Details of the construction plant and assumptions used for the construction assessment can be found in **Appendix 7.B Construction Noise Information [TR030008/APP/6.4]**.

7.5.7 The final piling rigs for the marine works are not yet confirmed. Different piling rigs may be used during construction but the pile hammer energy and noise levels associated with CG300 used in this assessment in **Paragraphs 7.9.26** to **7.9.34** is considered a realistic worst-case.

7.6 Study Area

7.6.1 There is no change to the overall study area set out in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**).

7.6.2 The study area covers the spatial extents over which potential direct and indirect airborne noise and vibration effects of the Project may occur during construction, operation and decommissioning at human receptors.

7.6.3 For construction noise and vibration on-site, the consideration of NSRs within up to 300 m of the Site Boundary is considered to be adequate to capture all significant effects, although additional residential receptors approximately 460m – 500m from the Site Boundary at the south-eastern edge of Immingham have also been considered for completeness. This includes residential NSRs on Queens Road as the residents of these properties may be present during construction.

7.6.4 For operational noise on-site, the study area extends to NSRs up to approximately 500m from the Site Boundary, which includes the residential NSRs at the south-eastern edge of Immingham. However residential NSRs on Queens Road are excluded from the operational assessment as the residential use of these buildings would need to cease for the hydrogen production facility to become operational, given the requirements of the Control of Major Accidents Hazards (“COMAH”) regulations.

7.6.5 For the assessment of changes in road traffic noise, NSRs within 50m of the roads which would be used by vehicles associated with construction and operational phase activities define the study area. Again, residential NSRs on Queens Road have been considered where appropriate during the construction phase, but not during the operational phase.

7.7 Baseline Conditions

Existing Baseline

7.7.1 The typical sources of sound contributing to the baseline sound environment at NSRs along Queens Road (in the vicinity of ML1 and I_ML5, and represented by NSR1 and NSR2 – as detailed in **Paragraphs 7.4.54** and **7.4.61**, and **Table 7-11**) are road traffic and industrial/commercial/port activities. More specifically, sound sources comprise road traffic on Queens Road outside the front of the residential properties, more distant road traffic from the A1173 to the west, industrial/commercial activities from premises to the north side of the Queens Road (Knauf Plant) and more general distant sound from industrial premises including power production, manufacturing, waste, port facilities in the wider area, and occasional distant aircraft.

7.7.2 At NSRs to the west of the Project on the eastern edge of Immingham (in the vicinity of ML2, ML3 and ML4 and represented by NSR3 and NSR4) sources likely to influence/dominate the baseline sound environment are the road traffic on the A1173 and A180, more distant industrial/commercial premises to the east of the A1173 (associated with power production, manufacturing, waste and port facilities) and occasional distant aircraft.

7.7.3 Descriptions of noise sources observed on site during the measurements for the Project at ML1, ML2 and I_ML3 during the daytime are included in **Table 7-14** and night-time noise sources are included in **Table 7-15**.

Table 7-14: Daytime measurement details

Location	Date	Time of day	Description of sound environment
ML1	04/10/2022	11:46-12:46	Dominated mainly by traffic noise from Queens Road. Other sources comprised a continuous, tonal sound from a factory north of Queens Road and distant traffic.
ML2	04/10/2022	11:30-13:00	Dominated by wind rustle in surrounding scrub. Other sources comprised of distant traffic on A1173, drive-bys of vehicles turning around, distant playground noise from nearby schools.
ML3	19/04/2023 – 26/04/2023	15.45 – 14.00	Alarm from east Port. Port noise, neighbouring dogs, A180 road noise, birdsong.

Location	Date	Time of day	Description of sound environment
ML4	19/04/2023 – 27/04/2023	14.00-11.45	Alarm from east Port. Occasional noise from footpath, A180 road noise, birdsong.
I_ML5	17/11/2022 24/03/2022 25/03/2022 03/03/2022	07.00 – 23.00 (number of visits undertaken to cover the full daytime period)	Dominated by road traffic noise from Queens Road with some contribution from a welding and fabrication workshop in the vicinity. Other sources include a steady industrial hum, and birdsong.

Table 7-15: Night-time measurement details

Location	Date	Time of day	Noise Description
ML1	04/10/2022	01:00-02:00	Dominated mainly by continuous, tonal sound from a factory north of Queens Road. Other sources comprised of traffic passing on Queens Road, the occasional release of steam from the factory in the north, distant industry, distant road noise from A1173 or A180.
ML2	04/10/2022	02:30-03:30	Dominated by wind rustle in surrounding scrub. Other sources comprised of distant road noise from A1173 or A180, unidentified whirring from west.
ML3	19/04/2023 – 26/04/2023	23.00-07.00	Unattended monitoring.
ML4	19/04/2023 – 27/04/2023	23.00-07.00	Unattended monitoring.
I_ML5	22/03/2022 23/03/2022	23.00 – 07.00	Dominated by a hum from a building to the northwest, intermittent and irregular high frequency bursts. Contribution from road traffic noise on Queens Road and other local roads.

7.7.4 A summary of the daytime sound levels for monitoring locations are presented in **Table 7-16**.

Table 7-16: Daytime sound levels during survey periods

Measurement Location	Start Time	Duration/ End Time	Measured sound levels			
			dB $L_{Aeq,T}$	dB $L_{AF90,T}$	dB $L_{AFmax,T}$	dB $L_{AF10,T}$
ML1	11:46	15 min	69	50	92	72
	12:01	15 min	70	49	89	73
	12:16	15 min	69	48	87	73
	12:31	15 min	69	49	88	73
ML2	11:30	15 min	41	48	68	53
	11:45	15 min	50	47	61	52
	12:00	15 min	49	46	58	51
	12:15	15 min	53	46	77	52
	12:30	15 min	51	46	74	53
	12:45	15 min	49	46	62	51
ML3	07:00 (20/4/23)	23:00	66	45	83	52
	07:00 (21/4/23)	23:00	50	45	75	50
	07:00 (22/4/23)	23:00	48	43	79	50
	07:00 (23/4/23)	23:00	47	40	73	49
	07:00 (24/4/23)	23:00	48	42	82	49
	07:00 (25/4/23)	23:00	47	41	76	48
ML4	07:00 (20/4/23)	23:00	62	45	83	50
	07:00 (21/4/23)	23:00	49	45	72	49
	07:00 (22/4/23)	23:00	46	38	75	47

Measurement Location	Start Time	Duration/ End Time	Measured sound levels			
			dB $L_{Aeq,T}$	dB $L_{AF90,T}$	dB $L_{AFmax,T}$	dB $L_{AF10,T}$
	07:00 (23/4/23)	23:00	45	40	78	46
	07:00 (24/4/23)	23:00	48	43	80	48
	07:00 (25/4/23)	23:00	47	41	76	48
I_ML5	07:12	1 hour	70	46	80	62
	08:12	1 hour	70	51	85	75
	09:12	1 hour	69	51	87	73
	10:12	1 hour	70	51	97	74
	11:12	1 hour	69	49	84	74
	12:09	1 hour	69	47	85	73
	12:41	1 hour	71	51	87	75
	13:09	1 hour	70	48	97	74
	13:41	1 hour	71	53	86	75
	14:09	1 hour	70	48	88	74
	14:41	1 hour	70	52	86	74
	15:09	1 hour	70	47	88	74
	16:24	1 hour	71	50	86	75
	17:24	1 hour	71	45	87	75
	18:23	1 hour	68	45	87	72
	19:23	1 hour	66	44	88	68
	20:23	1 hour	65	44	84	67
	21:00	1 hour	61	46	85	58
	22:00	1 hour	62	46	85	63

All values are in A-weighted dB re 20 µPa, Free-field

7.7.5 A summary of the night-time sound levels for the monitoring locations are presented in **Table 7-17**.

Table 7-17: Night-time sound levels during survey periods

Measurement Location	Start Time	Duration/ End Time	Measured sound levels			
			dB $L_{Aeq,T}$	dB $L_{AF90,T}$	dB $L_{AFmax,T}$	dB $L_{AF10,T}$
ML1	01:00	15 min	58	41	84	47
	01:15	15 min	60	42	87	47
	01:30	15 min	62	42	90	48
	01:45	15 min	54	41	81	45
ML2	02:30	15 min	41	38	51	53
	02:45	15 min	41	37	51	53
	03:00	15 min	40	36	51	53
	03:15	15 min	41	38	51	53
ML3	23:00 (19/4/23)	07:00	55	44	67	48
	23:00 (20/4/23)	07:00	45	41	70	45
	23:00 (21/4/23)	07:00	43	37	69	43
	23:00 (22/4/23)	07:00	43	38	67	45
	23:00 (23/4/23)	07:00	41	36	76	41
	23:00 (24/4/23)	07:00	41	38	71	41
	23:00 (25/4/23)	07:00	49	43	74	48

Measurement Location	Start Time	Duration/ End Time	Measured sound levels			
			dB $L_{Aeq,T}$	dB $L_{AF90,T}$	dB $L_{AFmax,T}$	dB $L_{AF10,T}$
ML4	23:00 (19/4/23)	07:00	57	44	71	48
	23:00 (20/4/23)	07:00	47	41	70	46
	23:00 (21/4/23)	07:00	44	36	69	43
	23:00 (22/4/23)	07:00	45	36	69	44
	23:00 (23/4/23)	07:00	44	38	71	43
	23:00 (24/4/23)	07:00	46	40	73	45
	23:00 (25/4/23)	07:00	49	40	74	47
I_ML5	23:00	1 hour	61	46	84	59
	00:00	1 hour	57	46	82	49
	01:00	1 hour	56	46	80	49
	02:00	1 hour	54	45	80	48
	03:00	1 hour	56	45	82	50
	04:00	1 hour	58	45	81	50
	05:00	1 hour	64	46	92	64
	06:00	1 hour	65	46	83	68

All values are in A-weighted dB re 20 µPa, Free-field

Representative Baseline Sound Levels

7.7.6 Representative baseline sound levels have been established for daytime and night-time periods. **Table 7-18** summarises the defined ambient sound levels and background sound levels taken forward within this ES for the NSRs in the vicinity of each noise monitoring location within the BS 5228 (Ref 7-2) construction noise assessment and the BS 4142 (Ref 7-5) operational sound assessment, respectively.

Table 7-18: Representative ambient (L_{Aeq}) and background (L_{A90}) sound levels

Assessment Period	NSR1 (eastern end of Queens Road) / ML1	NSR2 (western end of Queens Road) / l_ML5	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue) / ML3	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road) / ML2, ML4
Daytime L_{Aeq} dB (07.00 – 23.00)	69-70	69	58	55
Daytime L_{Aeq} dB (07.00 – 19.00)	69-70	70	51	50
Evening and Weekend L_{Aeq} dB *	N/A	65	46	45
Night-time L_{Aeq} dB (23.00 – 07.00)	54-62	60	48	50
Daytime L_{A90} dB (07.00 – 23.00)	49	47	41	39
Night-time L_{A90} dB (23.00 – 07.00)	41	46	39	37

* 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.

Future Baseline

7.7.7 Much of the Site Boundary bounds the operational Port of Immingham, which has been in active use for port purposes for a number of decades. The A1173 provides a major route for traffic to and from the A180 to the south and A160 to the northwest. Queens Road provides a key access to the eastern side of the Port and other industrial premises to the east and south off the A1173.

7.7.8 In the absence of the Project, the sound environment at NSRs in the vicinity would continue to be influenced/dominated by road traffic noise and port/commercial/industrial activity.

7.7.9 Future (2028) 'without' Project traffic (which included committed developments) as set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** has been reviewed to determine the potential change in future baseline sound levels at NSRs, with respect to road traffic noise. There is anticipated to be an increase in noise levels of between 1 to 3 dB on the roads within the traffic study area. However, as a worst case, the construction and operational assessment have been based on current baseline sound data.

7.8 Development Design and Impact Avoidance

7.8.1 The following mitigation measures for construction phase are standard mitigation measures that the construction contractor would follow as best practice and based on the guidance in BS 5228 (Parts 1 and 2) (Ref 7-2, Ref 7-3) as stated in the Outline Construction Environmental Management Plan ("CEMP"). For the operation phase the embedded mitigation measures are included as part of the design of the Project.

Construction Phase Noise and Vibration - Standard Mitigation

7.8.2 The core landside and marine construction working hours are stated in **Chapter 2: The Project [TR030008/APP/6.2]**. As stated in Chapter 2, some construction activities, such as major concrete pours, often take longer than the core construction hours. Where on-site works are to be conducted outside these core hours, they would comply with any restrictions agreed with the local planning authority. Any such works would be minimised and be carefully managed to reduce effects on local people.

7.8.3 Measures to mitigate noise and vibration would be implemented during the construction phase in order to minimise impacts at local NSRs, particularly with respect to any activities required outside of core working hours. Mitigation included the **Outline CEMP [TR030008/APP/6.5]** includes:

a. Ensuring that processes are in place to minimise noise and vibration before works begin and ensuring that best practical means ("BPM") are being achieved throughout the construction programme, including the use of localised screening around the main noise producing plant and activities.

b. All contractors will be familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2) (Ref 7-2; Ref 7-3), which will be a prerequisite of their appointment.

c. Ensuring that modern plant is used, complying with applicable UK noise emission requirements, and selection of inherently quiet plant where possible.

d. All pneumatic percussive tools will be provided with effective silencers/ acoustic covers.

e. Acoustic covers to engines will be kept closed when the engines are in use and idling.

f. Hydraulic techniques for breaking to be used, where practical, in preference to percussive techniques where reasonably practicable.

g. Use of lower noise and vibration piling (e.g. rotary bored or hydraulic jacking) rather than driven piling techniques, where reasonably practicable.

h. No start-up or shut down of vibratory rollers near to receptors.

i. Off-site pre-fabrication for components of the Project, where reasonably practicable.

j. All plant and equipment being used for the works to be properly maintained, silenced where appropriate, operated to prevent excessive noise and vibration and switched off when not in use.

k. Machines such as cranes that may be in intermittent use will be shut down between work periods or will be throttled down to a minimum. Machines will not be left running unnecessarily.

l. Where reasonably practicable, the contractor will use quieter working methods, the most suitable plant and reasonable hours of working for noisy operations.

m. Where possible, the noisiest items of plant will be located the furthest distance from the nearby NSRs. Plant known to emit noise strongly in one direction will, when possible, be orientated so that the noise is directed away from NSRs.

n. Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials within the Site to be conducted in such a manner as to minimise noise and vibration generation, as far as reasonably practicable.

o. No employees, subcontractors and persons employed on the Site will cause unnecessary noise from their activities e.g. excessive ‘revving’ of vehicle engines, shouting and other noisy behaviour. No radios or other audio equipment will be allowed on site.

p. Electrically powered plant will be used over diesel power generators where possible and feasible.

q. Audible warning systems (including reversing alarms) will be switched to the minimum setting required by the Health and Safety Executive.

r. Any tannoy system on site will be used for emergency use only.

s. All contractor communication devices will be used at a minimum audible level.

t. Appropriate routing of construction traffic on public roads and along access tracks, to reduce construction traffic noise, as far as reasonably practicable, as set out in the **Construction Traffic Management Plan** (“CTMP”) **[TR030008/APP/6.7].**

u. Monitoring of noise and vibration complaints and reporting to the contractor for immediate investigation.

7.8.4 Regular communication with the local community throughout the construction period will also serve to publicise the works schedule, giving notification to residents regarding periods when higher levels of noise and vibration may occur during specific operations, and providing lines of communication where complaints can be addressed.

7.8.5 Final CEMP(s) would be prepared by the Construction Contractor, based on the measures outlined above and detailed in the **Outline CEMP [TR030008/APP/6.4]** which accompanies the DCO Application. The Final CEMP(s) are secured by a Requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1].** The Final CEMP(s) would include provisions to ensure that the noise and vibration impacts relating to construction activities are reduced, as far as reasonably practicable. The need for monitoring of noise levels during construction will be determined through the detailed assessment undertaken in the Final CEMP(s).

Operational Phase Noise and Vibration – Embedded Mitigation

7.8.6 For the operational phase, embedded mitigation includes (but is not limited to) items on site that are required for the operation of the site but are not explicitly used for acoustic attenuation. Examples include concrete fire walls which will provide a level of screening of plant noise from different areas on site, such as from HPUs, Hydrogen Liquefiers and utility areas.

7.8.7 Design decisions, such as the lagging of pipework for on-site plant have also been applied within the operational noise model and form part of embedded mitigation.

7.8.8 **Table 7-19** describes the items of plant within the operational noise model that have embedded mitigation attenuation values assigned to them.

Table 7-19: List of embedded mitigation used within the operational noise model

Embedded Mitigation	Item of Plant attenuated by embedded mitigation	Level of attenuation provided. (dB)
Concrete Fire Walls	H2 Refueling Station – Reciprocating Pumps (Work Plan No. 7)	10
Lagging of pipework in accordance with ISO 15665	Intercooler Skids/Oil Removal Skids (all) (Work Plan No. 7a and 7b)	5

7.8.9 Details of the operational plant sound power level data, sound insultation performance and breakout noise from on-site buildings can be found in **Appendix 7.C Operational Noise Information [TR030008/APP/6.4]**.

7.8.10 The control and monitoring of noise during operation will be secured by a requirement in the **draft DCO [TR030008/APP/2.1]**.

7.8.11 The Site will be operated in accordance with an Environmental Permit, issued and regulated by the Environment Agency. This will require operational noise from the hydrogen production facility to be controlled through the use of Best Available Techniques ("BAT"), which will be determined through the Environmental Permit application.

Decommissioning Phase Noise and Vibration

7.8.12 The full details of decommissioning of the hydrogen production facility are uncertain at this time. However, the mitigation measures set out in this section for construction noise and vibration are also expected to be appropriate during the decommissioning stage.

7.8.13 Appropriate best practice mitigation measures to control noise effects will be applied during decommissioning works for the hydrogen production facility and are outlined in an outline **Decommissioning Environmental Management Plan** ("DEMP") **[TR030008/APP/6.4]** which accompanies the application). The Final DEMP is secured by a requirement in the **draft DCO [TR030008/APP/2.1]**. The need for monitoring of noise levels during decommissioning will be determined through the detailed assessment undertaken in the Final DEMP.

7.9 Assessment of Likely Impacts and Effects

7.9.1 This section contains an assessment of the impacts and effects on NSRs as a result of the construction, operational and decommissioning phases of the Project. The main focus of the assessment is on the landside operations for the hydrogen production facilities on Work Area No. 7, Work Area No. 5 and Work Area No. 3.

7.9.2 This is the part of the Project closest in proximity to residential NSR1 and NSR2 at Queens Road and residential NSR3 and NSR4 at the eastern edge of Immingham to the west and is also most likely to be impacted by the Project related road traffic on local roads.

7.9.3 The following impact pathways have therefore been assessed:

a. Potential noise and vibration impacts associated with activities on-site, during construction.

b. Potential vibration impacts on existing jetties and structures during marine piling.

c. Potential noise impacts associated with traffic movements on local highways, during construction.

d. Potential noise impacts from mechanical plant associated with the Work Area No. 7, Work Area No. 5, Work Area No.3, Hydrogen Liquefiers and HPUs activities, during operation.

e. Potential noise impacts associated with traffic movements on the local highways associated with export of liquified hydrogen product, during operation.

f. Potential noise and vibration impacts associated with activities on-site, during decommissioning of the hydrogen production facilities.

g. Potential noise impacts associated with traffic movements on the local highways, during decommissioning of the hydrogen production facility.

7.9.4 To summarise, the following pathways have been scoped out of the assessment:

a. Noise and vibration impacts on residential NSRs from works in the Work Area No. 5 and Work Area No. 1 during construction and decommissioning.

b. Vibration impacts on NSR 3 and NSR 4 from works in the Work Area No.7 during construction and decommissioning.

c. Vibration impacts from on-site operations.

d. Noise impacts from marine sea vessel movements (as explained in **Para 7.4.33**).

Construction Phase

7.9.5 Information regarding the construction works and programme are detailed in **Chapter 2: The Project [TR030008/APP/6.2]**.

Construction Noise Limits

7.9.6 Construction noise levels are likely to vary during different construction phases, depending on the location of work sites and proximity to NSRs. The nearest residential NSRs to the Site Boundary are on Queens Road (NSRs 1 and 2) and on the eastern edge of Immingham (NSRs 3 and 4). Based on the current ambient available noise levels at monitoring locations in both of these areas and the BS 5228 ABC category guidance in **Table 7-3**, construction noise limits based upon the measured data are:

a. **NSR1 and NSR2** – representative of residential NSRs on Queens Road:

   i. 75 dB $L_{Aeq,12hr}$ during week day daytime (07:00-19:00) and Saturdays (07:00-13:00).

   ii. 65 dB $L_{Aeq,12hr}$ during evening and weekends (19:00-23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 -23:00 Sundays)

   iii. 55 dB $L_{Aeq,8hr}$ during the night-time.(23:00-07:00 all nights)

b. **NSR3 and NSR 4** – residential NSRs on the eastern edge of Immingham**:**

   i. 65 dB $L_{Aeq,12hr}$ during week day daytime 07:00-19:00) and Saturdays (07:00-13:00).

   ii. 55 dB $L_{Aeq,12hr}$ during evening and weekends (19:00-23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 -23:00 Sundays)

   iii. 50 dB $L_{Aeq,8hr}$ during the night-time.(23:00-07:00 all nights).

7.9.7 Provided these noise limits, are not exceeded, the construction noise levels will be below the SOAEL.

Construction noise predictions from on-site works

7.9.8 The likely construction activities and the typical plant likely to be used during construction works have been considered based upon current information and using professional judgement.

7.9.9 The landside construction works have been broadly categorised into:

a. Site clearance
b. Piling and foundations
c. Underground drainage and services
d. Roads and hardstanding
e. Buildings and plant installation

7.9.10 Typical plant for the landside works in the Work Area No. 7 are likely to include:

a. Cranes
b. Telehandlers
c. Diesel generators
d. Hydraulic excavators
e. Dump trucks
f. Wheeled/front loaders
g. Tippers
h. Rollers
i. Asphalt/concrete plant
j. Concrete mixers and pumps
k. Compressors
l. Continuous flight auger piling rig

7.9.11 The noise levels generated by construction activities and experienced by nearby NSRs, such as residential properties, will depend upon a number of variables, the most important of which are:

a. The noise generated by plant or equipment used on site, generally expressed as sound power levels.
b. The periods of operation of the plant on the site, known as its ‘on-time’.
c. The distance between the noise source and the receptor.
d. The attenuation due to ground absorption, air absorption and barrier effects.
e. The existing noise environment and noise levels at the time of the works.

7.9.12 The construction noise predictions reported in this chapter have been undertaken using noise data for items of plant and calculation methodologies from BS 5228-1 and been based on construction methods used for similar projects. This gives an indication of where, at what stage, and during which construction activities, construction noise is at risk of leading to potentially adverse and significant adverse effects.

7.9.13 The predictions relate to construction activities being undertaken at the realistic closest location to each NSR irrespective of the phase of development i.e. the predicted noise level could occur at some stage during the full six phase build-out for NSRs 3 and 4. However, for NSR1 and NSR 2, the construction predictions are for Phase 1 only, as once Phase 1 becomes operational, NSR 1 and NSR 2 are will not be in residential use. The removal of residential use during the operational phase is secured by a requirement in Schedule 2 of the **draft DCO [TR030008/APP/2.1].** Predictions have also been carried out assuming that all of the above construction activities occur concurrently. This gives an indication of whether, during a potential worst-case scenario, construction noise is at risk of leading to significant adverse effects at residential NSRs.

7.9.14 The predicted levels apply to the weekday daytime and Saturday morning construction limits and evening and weekend construction limits (as listed in **Paragraph 7.9.6**) to cover the core construction hours as detailed in **Chapter 2: The Project [TR030008/APP/6.2].** The predicted construction levels could also be applied to other time periods where working at the same rate and intensity is proposed. Details regarding the noise prediction methodology, including a full list of indicative construction plant and associated sound power levels for each construction phase and assumptions, are presented in **Appendix 7.B [TR030008/APP/6.4]**.

7.9.15 A summary of indicative daytime noise level predictions at the NSR locations associated with the Work Area No. 7 construction is presented in **Table 7-20**. The indicative predicted noise levels include 5 dB to 10 dB attenuation (based on guidance in BS 5228 Table B.1 (Ref 7-2) due to the standard mitigation as detailed in **Section 7.7**.

7.9.16 As advised by BS 5228-1, noise levels predicted at distances over 300m (i.e. at NSRs 3 and 4 - residential NSRs at the eastern edge of Immingham) should be treated with caution due to the increasing importance of meteorological effects and therefore represent an overestimate.

Table 7-20: Predicted worst-case daytime construction noise levels - residential NSRs

Activity	Predicted construction noise level $L_{Aeq, T}$ dB (free-field)							
	NSR1 (eastern end of Queens Road)	Magnitude of Impact*	NSR2 (western end of Queens Road)	Magnitude of Impact*	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	Magnitude of Impact*	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	Magnitude of Impact*
Site clearance	73-78	Low-Medium (High)	71-76	Low-Medium (High)	52-57	Very Low (Low-Medium)	47-52	Very Low (Very Low-Low)
Piling and foundations	61-66	Very Low (Low-Medium)	67-72	Very Low-Low (Medium-High)	41-46	Very Low (Very Low)	36-41	Very Low (Very Low-Low)
Underground drainage and services	63-68	Very Low (Low-Medium)	67-72	Very Low-Low (Medium-High)	44-49	Very Low (Very Low)	38-43	Very Low (Very Low)
Roads and hard standing	73-78	Low-Medium (High)	70-75	Low (High)	49-54	Very Low (Very Low-Low)	44-49	Very Low (Very Low)

Activity	Predicted construction noise level $L_{Aeq, T}$ dB (free-field)							
	NSR1 (eastern end of Queens Road)	Magnitude of Impact*	NSR2 (western end of Queens Road)	Magnitude of Impact*	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	Magnitude of Impact*	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	Magnitude of Impact*
Buildings and plant installation	65-70	Very Low (Low-Medium)	69-74	Very Low (High)	44-49	Very Low (Very Low)	39-44	Very Low (Very Low)
All values are in A-weighted dB re 20 µPa, free-field * Magnitude of impact in brackets are for the Saturday afternoon period.								

7.9.17 Based on the above, and using professional judgement for Work Area No. 7 construction works, there is the potential for short-term temporary medium adverse impacts to arise if significant construction works for site clearance, and construction of site roads and hardstanding are undertaken at the closest location within the Site Boundary to the nearest NSRs on Queens Road. Based on the sensitivity of the NSRs (high) as shown in **Table 7-12** of this Chapter, this could result in up to **moderate adverse** effects which are **significant**.

7.9.18 For construction activities undertaken on Saturday afternoons (between 13:00 and 19:00), there is the potential for short-term temporary high adverse impacts to arise if significant construction works for site clearance, piling and foundations, construction of site roads and hardstanding and building and plant installation are undertaken at the closest location within the Work Area No. 7 Boundary to the nearest NSRs on Queens Road. Based on the sensitivity of the NSRs (high) as shown in **Table 7-12** of this Chapter, this could result in up to **major adverse** effects which are **significant.**

7.9.19 At the NSR3 and NSR4 on the eastern edge of Immingham, for example around Spring Street, Waterworks Road, Chestnut Avenue, Talbot Road Worsley Road, and Somerton Road, due to the much greater separation distance of between 460 – 530 m from the construction activities, predicted worst-case daytime construction noise levels would result in short-term temporary very low adverse impacts. Based on the sensitivity of the NSRs (high) as shown in **Table 7-12** of this Chapter, this could result in negligible effects which are not significant.

7.9.20 For construction activities undertaken on Saturday afternoons (between 13:00 and 19:00), there is the potential for short-term temporary medium adverse impacts to arise if significant construction works for site clearance, are undertaken at the closest location within the Work Area No. 7 Boundary to the nearest NSRs on Spring Street, Waterworks Road, and Chestnut Avenue. Based on the sensitivity of the NSRs (high) as shown in Table **Table 7-12** of this Chapter, this could result in up to **moderate adverse** effects which are **significant.**

7.9.21 Additional mitigation measures outlined in **Section 7.8** would further assist in minimising construction noise impacts.

Construction vibration impacts on humans from on-site activities

7.9.22 The level of impact at different receptors will be dependent upon a number of factors, including distance between the works and receptors, ground conditions, the nature and method of works required close to receptors and the specific activities being undertaken at any given time.

7.9.23 Typically construction works requiring piling or heavy machinery such as vibratory rollers can be associated with potentially significant levels of vibration. Piling is currently expected to be required on the Work Area No. 7; however, rotary bored or continuous flight auger piling is currently proposed, rather than impact driven piling. As stated in BS 5228 (Ref 7-2) vibration associated with continuous flight auger piling is minimal “as the processes do not involve rapid acceleration or deceleration of tools in contact with the ground but rely to a large extent on steady motions”.

7.9.24 Road rollers are currently proposed to be used at the Work Area No. 7, but it is has been confirmed that vibratory rollers will not be used in close proximity of receptors on Queens Road, therefore, there would be no significant adverse effects in terms of vibration annoyance to occupants.

7.9.25 Due to large distances (minimum of 460m) between residential receptors on the east edge of Immingham and Work Area No. 7, vibration effects on both humans and buildings would be negligible.

Construction vibration impacts on the Immingham Oil Terminal Pipeline

7.9.26 As detailed in **Chapter 2: The Project [TR030008/APP/6.2] and Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**, piling will be required for the marine works; it is anticipated that this would likely use vibro/percussive techniques.

7.9.27 The transmission of ground-borne vibration is highly dependent on the nature of the intervening ground between the source and receiver and the activities being undertaken.

7.9.28 To provide an initial assessment of likely vibration impacts on the IOT jetty empirical formulae derived by Hiller and Crabb (2000) has been used to predict a resulting PPV based on various piling parameters. The equations are summarised in Table E.1 in BS 5228 Part 2 (Ref 7-3) and the relevant ones shown below.

7.9.29 The equation used to predict PPV for percussive piling is:

$$v_{res} \leq k_p \left[\frac{\sqrt{W}}{r^{1.3}}\right]$$

a. where:

   i. k_p is the scaling factor which is dependent on ground conditions. A value of 3 has been used (pile toe to be driven through: very stiff cohesive soils, dense granular soils, fill containing obstructions which are large relative to pile cross section).

   ii. W is the nominal hammer energy. 300,000 J have been used for this assessment (based on GC 300 piling rig).

   iii. r is the slope distance from the pile toe in metres, the closest distance from the IOT jetty to the piling area for IGET Jetty is approximately 178m.

7.9.30 Predicted PPV for vibratory piling in mm/s:

$$v_{res} = \frac{k_v}{x^{\delta}}$$

a. k_v is the scaling factor for vibratory piling, and for a worst-case assessment 266 has been used.

b. x is the distance measured along the ground surface in metres from the piling rig to the receptor. The closest distance from the IOT jetty to the piling area for IGET jetty is approximately 178 m.

c. δ is 1.3 for all operations.

7.9.31 The resultant predicted PPV for percussive and vibratory piling is shown in **Table 7-21** below together with the resultant magnitude of impact based upon **Table 7-8**. The existing jetties and pipelines are considered to be reinforced structures.

Table 7-21: Resultant PPV for percussive and vibratory piling

Receptor	Percussive Piling (300000 J)		Vibratory Piling	
	Predicted ppv Levels mm/s	Magnitude of Impact	Predicted ppv Levels mm/s	Magnitude of Impact
IOT Jetty	2.0	Very Low	0.3	Very Low

7.9.32 This initial vibration assessment shows the predicted PPV levels for percussive piling using a piling rig with 300000 J hammer energy are likely to result in a very low magnitude of impact (based on **Table 7-8** of this Chapter) for building damage, which will result in a **negligible adverse** effect (not significant).

7.9.33 Different piling rigs may be used during construction, but the pile hammer energy associated with the CG300 rig (300000J) is considered a worst case.

7.9.34 The predicted PPV levels for vibratory piling are likely to result in a very low magnitude of impact (based on **Table 7-8** of this Chapter), resulting in a **negligible adverse** effect (not significant).

Construction traffic on the local highway network

7.9.35 Construction traffic data has been provided from the assessment reported in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** for the traffic scenario 'without' and 'with' IGET construction traffic for 2026, which is the peak year for construction activity for all roads within the scope of the transport assessment as follows:

a. Scenario 1- 'without' IGET construction traffic: 2026 base flows + committed developments.

b. Scenario 2 –'with' IGET construction traffic: 2026 base flows + committed developments.

7.9.36 The traffic speed used is based on the road speed limit for each road link, and it has been assumed that traffic speeds will remain the same for all scenarios. Based on the 18hr AAWT flows, % HGVs and speed, the potential changes in road traffic noise from these road links as a result of the IGET construction traffic (i.e. by comparing the with and without IGET scenarios) have been considered by calculating the CRTN BNL at 10m from each road link.

7.9.37 **Table 7-22** below presents the results of the assessment together with the magnitude of impact classifications as set out in **Table 7-5** of this ES Chapter.

Table 7-22: Predicted change in construction road traffic noise levels

Road Link	Short-Term Change in BNL, (dB $L_{A10,18hr}$)	Magnitude of Impact
A180 E - Between East of A180/A1173 Junction	0.1	Negligible (Very Low)
A1173 - Between A1173/Kiln Lane and A1173/Kings Road	0.3	Negligible (Very Low)
Queens Road (WORK AREA NO. 7) - between A1173/Kings Road and Queens Road/Laporte Road	0.9	Negligible (Very Low)
Queens Road (WORK AREA NO. 5) - between A1173/Kings Road and Queens Road/Laporte Road	0.4	Negligible (Very Low)
Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	0.1	Negligible (Very Low)
Manby Road - between A160/Manby Road and Kings Road/Pelham Road	0.0	Negligible (Very Low)
A160 - Between Manby Road/A160 and A160/A1077 Roundabout	0.0	Negligible (Very Low)
A160 - Between A160/A1077 Roundabout and A160/A180	0.0	Negligible (Very Low)
A180 W - Between A180/A1173 and A180/A160	0.1	Negligible (Very Low)
Laporte Road	0.1	Negligible (Very Low)

7.9.38 **Table 7-22** above shows predicted changes in traffic noise on all road links will result in a negligible magnitude of impact at nearby NSRs in both short-term and long-term scenarios. These predicted changes in construction traffic noise level will result in negligible effects (not significant) at all NSRs along the road links.

Operational Phase

Operational sound predictions from on-site plant

7.9.39 The operational facilities and equipment associated with the hydrogen production facility are located within Work Area No. 3, Work Area No.5 and Work Area No. 7, as shown in **Figure 2.3 [TR030008/APP/6.3]).**

7.9.40 On site plant been modelled as part of a "reasonable worst case" scenario based on the noisiest possible configuration of HPUs and Hydrogen Liquefiers within each applicable Work area as described in **Paragraph 7.5.5**.

7.9.41 Several models have been produced to seek out the potential worst-case scenario and highest noise levels at NSR. This has been through modelling different layouts of HPUs and Hydrogen Liquefier units across the Work Plan areas, and changes in unit orientation.

7.9.42 In analysing the different model variations that have been produced, the highest predicted noise levels at NSR have been used within the assessment.

7.9.43 There is limited scope for substantive change in layout of plant items within the HPUs and Hydrogen Liquefier areas across Work Area No. 3, Work Area No. 5 and Work Area No.7 due to the necessary process function.

7.9.44 This modelling of the Project layout is undertaken without additional noise mitigation above that is considered as embedded or standard as described in **Paragraph 7.8.6** and is therefore considered a reasonable worst-case assessment scenario.

7.9.45 The operational noise modelling comprises two main scenarios: Phase 1 operation of the associated development, potentially representative of the first three years after opening, and then full operation of Phases 1-6 thereafter.

7.9.46 Further details of the sound source sound power level data, the settings used in the noise modelling software and the list of assumptions used are presented in **Appendix 7.C [TR030008/APP/6.4]**.

7.9.47 In the absence of additional mitigation, the predicted free-field operational specific sound levels at the NSRs around the Site Boundary are presented in **Table 7-23**.

Table 7-23: Predicted worst-case operational specific sound levels

Phase	Predicted operational specific sound level $L_{Aeq,Tr}$ dB free-field	
	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)
Phase 1 Only	43-47	44-47
Phases 1-6 (full operation)	46-49	47-50

7.9.48 The NSRs presented represent the worst affected within the study area. It is anticipated that once constructed, the plant on-site will operate 24/7 and therefore the predicted sound levels could apply to both the 1-hour daytime or 15-minute night-time BS 4142 (Ref 7-5) assessment periods.

BS4142 assessment results

7.9.49 The magnitude of impact and effect classification has been included in **Table 7-24** and **Table 7-25**, to provide context for the BS 4142 assessment outcomes, with reference to the semantic scales in **Table 7-10**, **Table 7-11** and **Table 7-12**.

7.9.50 The values presented are the differences between the representative background sound level at each NSR (**Table 7-18**) and the predicted rating level (the specific sound level $L_{Aeq,T}$ presented in **Table 7-23** plus the character correction). Positive values in the table indicate an excess of the rating level over the background sound level. The representative background sound levels have been taken from **Table 7-18**.

7.9.51 The assessment has assumed that potential noise of a tonal, impulsive or intermittent nature will be designed out of the Project during the detailed design phase by the selection of appropriate plant, building cladding, louvres and silencers/ attenuators as necessary. However, inclusion of a +3 dB correction for other distinctive character has been included at this stage as a conservative approach for NSR with the potential to identify the new sound source in their existing acoustic environment.

Table 7-24: Daytime BS4142 assessment (without additional specific mitigation)

Receptor	Phase 1 only		Phase 1-6 (full operation)	
	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)
Specific sound level L_s ($L_{Aeq,Tr}$), dB	43-47	44-47	46-49	47-50
Acoustic feature correction, dB	+3	+3	+3	+3
Rating level ($L_{Ar,Tr}$), dB	46-50	47-50	49-52	50-53
Representative *background sound level* ($L_{A90,T}$), dB	41	39	41	39
Excess of *rating level* over *background sound level* ($L_{Ar,Tr}$ - $L_{A90,T}$), dB	+5 - +9	+8 - +11	+8- +11	+11 - +14
Magnitude of impact (assigned from **Table 7-9**)	Low - Medium	Low/Medium - Medium	Low/Medium - Medium	Medium - High
Initial BS 4142 classification of effect (assigned from **Table 7-13**)	Minor/Moderate adverse	Minor/Moderate - Moderate adverse	Minor/Moderate - Moderate adverse	Moderate - Major adverse

Receptor	Phase 1 only		Phase 1-6 (full operation)	
	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)
Uncertainty: The sound source data used within the operational noise model is based on data captured at existing sites and from available manufacture data				

Table 7-25: Night-time BS4142 assessment (without additional specific mitigation)

Receptor	Phase 1 only		Phase 1-6 (full operation)	
	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)
Specific sound level L_s ($L_{Aeq,Tr}$), dB	43-47	44-47	46-49	47-50
Acoustic feature correction, dB	+3	+3	+3	+3
Rating level ($L_{Ar,Tr}$), dB	46-50	47-50	49-52	50-53
Representative *background sound level* ($L_{A90,T}$), dB	39	37	39	37

Receptor	Phase 1 only		Phase 1-6 (full operation)	
	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)	NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue))	NSR4 (vicinity of Talbot Road, Worsley Road & Somerton Road)
Excess of *rating level* over *background sound level* ($L_{Ar,Tr}$ - $L_{A90,T}$), dB	+7 - +11	+10 - +13	+10 - +13	+13 - +16
Magnitude of impact (assigned from **Table 7-9**)	Low/Medium - Medium	Medium – Medium/High	Medium – Medium/ High	Medium / High - High
Initial BS 4142 classification of effect (assigned from **Table 7-13**)	Minor/Moderate – Moderate adverse	Moderate – Major adverse	Moderate – Major Adverse	Major Adverse
Uncertainty: The sound source data used within the operational noise model is based on data captured at existing sites and from available manufacture data				

7.9.52 In accordance with **Table 7-10**, the values presented in **Table 7-24** and **Table 7-25** produce a range of impact magnitudes resulting in effects ranging between **minor adverse** (not significant, and below the LOAEL) to **major adverse** (significant, and at or above the SOAEL), before consideration of context as below.

Consideration of context

7.9.53 The Site is adjacent to the operational area of the Port of Immingham, one of the busiest ports in the UK, operating 24 hours a day, 365 days a year. The area surrounding the Port is also primarily industrial in nature, being dominated by chemical manufacturing, oil processing and power generation facilities. Beyond the industrial facilities, the wider area is largely agricultural.

7.9.54 The landside elements of the Project will replace some temporary storage activities currently operating on parts of the Project site and also use areas zoned for future employment enterprise zone. This, as well as the existing operational port traffic using Queens Road, Laporte Road and other nearby access routes is likely to mean that many residents in the local communities are already accustomed to an industrial sound environment.

7.9.55 **Table 7-26** presents existing and future predicted ambient sound levels (assuming constant operation of the Project) and compares them to the BS8233:2014 and WHO 'Guidelines for Community Noise' recommended indoor ambient sound level for sleeping. The recommended internal criterion is 30 dB $L_{Aeq,8h}$, which would be equivalent to an external criterion of 45 dB $L_{Aeq,8h}$ assuming open bedroom windows for ventilation. The predicted change in ambient sound levels can also be contextualised in accordance with **Table 7-10.**

Table 7-26: Comparison of ambient sound levels without additional mitigation

Receptor	Time Period	Existing *ambient sound level* $L_{Aeq,T}$, dB	Predicted *specific sound level*, $L_{Aeq,Tr}$, dB	Sum of existing *ambient sound level* and predicted *specific sound level* $L_{Aeq,Tr}$, dB	Predicted increase in existing *ambient sound level* due to the Project, $L_{Aeq,Tr}$, dB
NSR3 (vicinity of Spring Street, Waterworks Street & Chestnut Avenue)	Daytime (16 hour)	58	46 – 49	58-59	0 - +1
	Night-time (8 hour)	48	46 – 49	50-52	+2 - +4
NSR4 (vicinity of Talbot	Daytime (16 hour)	55	47 – 50	56	+1

Receptor	Time Period	Existing *ambient sound level* $L_{Aeq,T}$, dB	Predicted *specific sound level*, $L_{Aeq,Tr}$, dB	Sum of existing *ambient sound level* and predicted *specific sound level* $L_{Aeq,Tr}$, dB	Predicted increase in existing *ambient sound level* due to the Project, $L_{Aeq,Tr}$, dB
Road, Worsley Road & Somerton Road))	Night-time (8 hour)	40	47 – 50	47-50	+8 -+10

7.9.56 As shown in **Table 7-26**, ambient sound levels increase due to the predicted levels from the Project, and all are above the BS8233:2014/WHO external criterion of 45 dB $L_{Aeq,8h}$. The predicted levels of increase in ambient sound level would be classified as Low during the daytime period for NSR 3 and NSR 4 in accordance with **Table 7-10**. During the night-time period the predicted levels of increase in ambient sound level would be classified as Medium for NSR 3 and High for NSR 4 in accordance with **Table 7-10**.

7.9.57 On this basis of the above BS 4142 assessment, and that there is likely to be a desire to reduce noise levels to the LOAEL (no greater than +5 dB excess of rating level over background sound level) or lower, potential additional mitigation options to reduce noise levels are discussed in **Section 7.10**.

Operational Road Traffic

7.9.58 As stated in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** the operational daily flows are lower than during construction. Given that the construction traffic noise assessment (see **Table 7-22**) concludes that there are negligible effects, the operational traffic noise effects will be negligible or no change. As stated in **Paragraph 7.6.4,** the closest NSRs to the Work Area No. 7 on Queens Road will not be occupied during the operational phase.

Decommissioning of the hydrogen production facility

7.9.59 The effects of decommissioning the hydrogen production facilities are considered to be comparable to, or less than, those assessed for construction activities and given the distance to the nearest NSRs (NSR 3 and 4) the potential for adverse noise effects is unlikely and would results in Not Significant adverse effects.

7.9.60 Decommissioning would require submission of a Final DEMP to NELC for its approval, this is secured by a requirement in the **draft DCO [TR030008/APP/2.1]** and the DEMP is in Schedule 2 of the **draft DCO [TR030008/APP/2.1]** secured by a requirement of the draft DCO. The Final DEMP would be prepared in accordance with the **Outline DEMP [TR030008/APP/6.6]** which is submitted as part of the application. Appropriate best practice mitigation measures will be applied during any decommissioning works, as described in **Section 7.8**, and documented in the DEMP; no additional mitigation for decommissioning of the

Project beyond such best practice specified in BS 5228 and **Section 7.8** mitigation is considered necessary to specify at this stage.

7.10 Mitigation Measures

7.10.1 Further consideration will be given to the potential options to minimise noise and vibration during the detailed design of the Project. Nevertheless, at this stage, measures to mitigate construction noise and vibration and operational sound, in addition to those set out in **Section 7.7** are discussed below.

Construction Phase

7.10.2 Based upon the current assessment, noise effects of up to major adverse (significant, and above the SOAEL) are predicted at Queens Road (represented by NSR1 and NSR2) during site clearance, and construction of roads and hardstanding on weekday daytime/Saturday mornings and up to major adverse for construction activities on Saturday afternoons. Moderate adverse (significant) effects are predicted at NSR3 if significant site clearance works takes place on Saturday afternoons.

7.10.3 The preferred approach for controlling construction noise and vibration is to reduce levels at source, where reasonably practicable. Sometimes a greater noise or vibration level may be acceptable if the overall construction time, and therefore length of disruption, is reduced.

7.10.4 In addition to the noise control measures presented within **Section 7.8** of this Chapter, when plant is operating near the Queens Road NSRs and NSRs on Spring Street, Waterworks Road, and Chestnut Avenue during site clearance on Saturday afternoons, additional noise-control equipment such as jackets on pneumatic drills, acoustic covers on compressors, shrouds on piling rigs and cranes will be implemented. The use of temporary barriers or screens can also provide additional mitigation. These additional mitigation measures can provide up to 15 to 20 dB sound reduction (based on Table B.1 in BS 5228 (Ref 7-2). These additional methods will be detailed in the Final CEMP once the final construction plant and methods have been confirmed.

7.10.5 The need for monitoring of noise levels during construction will also be determined through the detailed assessment undertaken at the Final CEMP.

7.10.6 Residual effects after mitigation are described in **Section 7.11**.

Operational sound from on-site plant

7.10.7 Based upon the current assessment, for NSRs on the eastern edge of Immingham to the west (NSR3 and NSR 4), predicted effects range between negligible/minor adverse, minor/moderate adverse (potentially significant, with some NSRs being at or above the LOAEL and approaching the SOAEL) to major adverse (significant, and above the SOAEL) depending upon time period and phase of Project buildout.

7.10.8 As stated in **Section 7.4** the operational assessment has assumed that potential sound of a tonal, impulsive or intermittent nature (according to BS4142: 2014) will be designed out of the Project during the detailed design phase through the selection of appropriate plant, building cladding, louvres and silencers/ attenuators as necessary. This is secured by a requirement in the **draft DCO [TR030008/APP/2.1]**. Based on the worst-case results presented in **Section 7.8**, additional mitigation would be required to achieve the operational daytime and night-time LOAEL criterion of a rating level no greater than +5 dB above the defined representative background sound level at each NSR.

7.10.9 The potential mitigation measures and general principles to achieve this may include, but are not limited to, the following measures, depending upon the potential benefits achieved from such measures:

a. Reducing the breakout noise from plant through the use of enhanced enclosures, or potentially containing them within a building.

b. Reducing air inlet noise emissions by the addition of further in-line attenuation.

c. Reducing Flare Stack outlet noise emissions by the addition of silencers or sound proofing panels.

d. Reducing fan noise emissions by screening, re-sizing, fitting low noise fans or attenuation.

e. Screening or enclosing the compressors or other equipment.

f. Orientation of plant within the site to provide screening of low-level noise sources by other buildings and structures, or orientating fans and the air inlets away from sensitive receptors.

7.10.10 **Table 7-27** outlines the overall attenuation required to achieve the daytime and night-time operational sound criteria i.e. the rating level to be no greater than +5 dB above the defined representative background sound level at each NSR.

Table 7-27: Overall attenuation (dB) required to achieve operational sound criteria (Full site operational)

Receptor	Required attenuation to achieve daytime +5 dB criterion	Required attenuation to achieve night-time +5 dB criterion
NSR 3	+9	+11
NSR 4	+11	+14

7.10.11 The sound contribution at each NSR from each modelled sound source across the Project has been ranked. The potential attenuation required from the source sound power levels of the key noise emitting plant in order to meet a rating level of no greater than +5 dB above the defined representative background sound level at each NSR is listed in **Table 7-28**. These reductions could be achieved either through reduction of sound power level at source or by application of the mitigation measures listed above.

7.10.12 During detailed design stage it may be more practical to apply higher attenuation to some plant items/buildings than the attenuation levels listed in **Table 7-10** in order to reduce the attenuation applied to other plant items/ buildings and still achieve the +5dB criterion. It is also possible that changes will be proposed to plant specification or the number of plant required on-site for normal process function. It is envisaged that the Operational Noise Management Plan which is secured by a requirement in the **draft DCO [TR030008/APP/2.1]** would set out the appropriate mitigation. The residual effects after additional mitigation has been implemented are described in **Section 7.11**.

Table 7-28: Attenuation required (dB) from individual plant items.

Plant	Location	Quantity	Required attenuation to achieve a *rating level* no greater than +5 dB above defined *background sound level*
Individual Items of Plant			
H2 Refueling Station - Reciprocating Pumps	Work Area No. 7 (HRS) Hydrogen Refueling Station	2	30* (10 dB embedded, 20 dB additional)
Two N2 Companders + Lube Oil System	Work Area No. 7 (LHY35) Hydrogen Liquefiers Areas	4	20
HP Tube Fill Compressor – Glycol Circuit Air Cooler	Work Area No. 7 Compression Area	6	15
HP Tube Fill Compressor – Hydraulic Oil Pump Motor	Work Area No. 7 Compression Area	6	15
LP Tube Fill Compressor	Work Area No. 7 Compression Area	2	15

Plant	Location	Quantity	Required attenuation to achieve a *rating level* no greater than +5 dB above defined *background sound level*
LP Tube Fill Compressor Motor	Work Area No. 7 Compression Area	2	15
Cooling Tower - Cooling Water Motor Pump	Work Area No. 7	6	15
Cooling Tower - Cooling Water Pump Motor	Work Area No. 7	6	15
Cooling Tower Fan Air Outlet	Work Area No. 7	6	5
Air-Cooled Intercooler	Work Area No. 7 Compression Area	8	10
Chiller for K400A/B/C/D Aftercooler	Work Area No. 7 Compression Area	1	10
Common Air-Cooled Cylinder Jacket Water Cooler	Work Area No. 7 Compression Area	1	10
Intercooler Skids/Oil Removal Skids	Work Area No. 7 Hydrogen Liquefiers Areas	18 x 4 Liquefier Areas	10* (5 dB embedded, 5 dB additional)
Common Air-Cooled Cylinder Jacket Water Cooler	Work Area No. 7 Compression Area	1	10
Intercooler Skids/Oil Removal Skids	Work Area No. 7 Hydrogen Liquefiers Areas	18 x 4 Liquefier Areas	10* (5 dB embedded, 5 dB additional)
Nitrogen Generator (24HPN) Package Expanders Vacuum Can S218	Work Area No. 7	1 of each item as part of the 24HPN package	10

Plant	Location	Quantity	Required attenuation to achieve a *rating level* no greater than +5 dB above defined *background sound level*
Compressor Inlet Filter Compressor with on skid close-fit enclosure Tepsa Skid C182A/B U004 Process Container U004 Vent			
H2 PSA (Work Area No. 7 Only)	Work Area No. 7 HPU Area	3 x Work Area No. 7	10
Air Inlet – FD Fan	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	10
Flue Stack (ID Fan)	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	10
ID Fan	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5
FD Fan	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5
FD Fan Motor	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5
ID Fan Motor	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5

Plant	Location	Quantity	Required attenuation to achieve a *rating level* no greater than +5 dB above defined *background sound level*
ID Fan Inlet Ducting (Insulated)	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5
FD Fan Inlet Ducting (Insulated)	Work Area No. 7 and Work Area No. 5 HPU Area	3 x Work Area No. 7 3 x Work Area No. 5	5
NH3 Hydrogen Production Unit – (Work Area No. 7 Only) Burner Pipes: West Wall Only	Work Area No. 7 HPU Area	3 x Work Area No. 7	5
East Ammonia Storage Boil Off Gas Compressor Package with Enclosure	Work Area No. 5	2	10
Buildings			
LHY35 Compressor Building - 4 Walls and Roof	Work Area No. 7 Hydrogen Liquefiers Area	4 x Work Area No. 7	10
Cooling Tower Air Inlet Face Side A	Work Area No. 7	1 x Work Area No. 7	10
Cooling Tower Air Inlet Face Side B	Work Area No. 7	1 x Work Area No. 7	10

**The level of attenuation includes "embedded mitigation" which takes into account attenuation that has been already considered and implemented during the initial design phases of the Project.*

7.11 Assessment of Residual Effects

Construction

7.11.1 Based on the implementation of the impact avoidance measures, and following implementation of additional noise specific measures to be secured in the final CEMP, which will help minimise the risk of noise complaints and potential enforcement action under the CoPA by NELC, this assessment concludes that residual construction noise effects at residential NSRs on Queens Road (represented by NSR1 and NSR2) is likely to be of Minor adverse not significant from on-site works. However, as explained in **Chapter 2: The Project** and **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**, it is considered that the continued residential use of the residential properties (the residential NSRs) on the west side of Queens Road is considered incompatible with the operation of the hydrogen production facility. Discussions are ongoing with the owners and occupiers with a view to negotiating their acquisition by agreement. Where it is not possible to acquire those properties through negotiation, compulsory acquisition powers for these properties will be sought through the DCO. In the event of acquisition of the properties ahead of the construction commencing, the adverse effect would not arise.

7.11.2 At residential NSRs to the west at the eastern edge of Immingham (represented by NSR3 and NSR 4), residual construction noise effects are likely to be of **negligible** significance (**not significant**, and below the LOAEL).

Operation

7.11.3 Based on the implementation of the impact avoidance measures, and following implementation of additional noise specific mitigation measures as outlined within the Schedule of Mitigation **[TR030008/APP/7.2]**, which will help minimise the risk of noise complaints and potential enforcement action under the EPA by NELC, this assessment concludes that residual effects at residential NSRs at the eastern edge of Immingham (represented by NSR3 and NSR 4), residual effects of operational sound are likely to be minor adverse significance (not significant, and not exceeding the LOAEL) once mitigation measures have been deployed.

7.11.4 During detailed design, an operational noise management plan will be prepared, and this is secured by a requirement in the **draft DCO [TR030008/APP/2.1]**. It is expected that that when the operational noise management plan is prepared, discussions with NELC will be required to agree the appropriate baseline(s) for future project phases (The assessment within this chapter uses current baseline data, obtained in 2022 and 2023).

Decommissioning

7.11.5 Residual effects for NSR 3 and NSR 4 during decommissioning of the hydrogen production facilities are expected to be equivalent to those presented above for construction.

7.12 Summary of Assessment

7.12.1 A summary of the impact pathways that have been assessed, and the identified residual effects and level of confidence are presented in **Table 7-29**.

Table 7-29: Summary of potential impact, mitigation measures and residual effects

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Residential NSRs on Queens Road (NSR 1 and NSR 2)	Construction Noise - Landside works	Potentially up to moderate adverse (significant) (daytime) Potentially up to major adverse (significant) (Saturday afternoons)	Standard impact avoidance construction noise and vibration mitigation measures. Additional specific measures where possible (use of noise-control equipment such as jackets on pneumatic drills, acoustic covers on compressors, shrouds on piling rigs and cranes), temporary acoustic barriers and screens.	Minor adverse (not significant)	Medium
Residential NSRs on eastern edge of Immingham (NSR 3 and NSR 4)	Construction Noise - Landside works	Negligible adverse (not significant) (daytime) Potentially up to moderate adverse (significant) (Saturday afternoons)	Standard impact avoidance construction noise and vibration mitigation measures. Additional specific measures where possible during site clearance works on Saturday afternoon e.g. use of noise-control equipment such as jackets on pneumatic drills, acoustic covers on compressors, shrouds on and cranes, temporary acoustic barriers and screens.	Negligible-Minor adverse (not significant)	Medium
Residential NSRs on Queens Road (NSR 1 and NSR 2)	Construction vibration (landside works)	Minor Adverse (not significant)	Use of non-vibratory rollers	Minor adverse (not significant)	Medium

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
Residential NSRs on adjacent to construction traffic routes	Construction Traffic	Negligible (not significant) (daytime)	CTMP	Negligible (not significant)	Medium
Immingham Oil Terminal Jetty/ Pipeline	Construction/Piling Vibration (Marine Works)	Negligible (not significant)	N/A	Negligible (not significant)	Medium
Residential NSRs	Construction noise impacts from sea vessel movements	Negligible adverse (not significant)	N/A	Negligible adverse (not significant)	Medium
Operational Phase*					
Residential NSRs on eastern edge of Immingham	On-site plant noise and operations	Up to moderate/major adverse (significant) (daytime) and up to major adverse (significant) (night-time)	Limits on noise emissions from plant and equipment at source, including the use of silencers/attenuators on items of plant where applicable. Acoustic barriers/screens local to the items of plant and equipment to reduce transmission of noise from the Site to NSRs.	Minor adverse (not significant)	Medium/High
Residential NSRs adjacent to operational traffic routes	Project traffic on local roads	Negligible adverse (not significant)	N/A	Negligible (not significant)	Medium
Decommissioning Phase – as per construction phase					

* As explained in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**, it is considered that the residential use of the residential properties (the residential NSRs) on the west side of Queens Road (numbers 1-6, flats above 7-8 and 18 and 31) is incompatible with the hydrogen production facility and therefore that residential use of those properties would need to be cease. The Applicant is currently in discussions with the landowners / occupiers with a view to negotiating acquisition of the properties and acquisition powers are sought through the draft DCO. In the event of acquisition of the properties ahead of either construction or operation commencing, the adverse effect would not arise.

7.13 References

Ref 7-1 British Standards Institute (BSI). (2003). BS 7445-1 – Description and measurement of environmental noise. Guide to quantities and procedures

Ref 7-2 British Standards Institute (BSI). (2014). BS 5228:2009+A1:2014: Code of practice for noise and vibration control on construction and open site– Part 1: Noise'.

Ref 7-3 British Standards Institute (BSI). (2014). BS 5228:2009+A1:2014: Code of practice for noise and vibration control on construction and open site – Part 2: Vibration'.

Ref 7-4 British Standards Institute (BSI). (2014). BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'.

Ref 7-5 British Standards Institute (BSI). (2019). BS 4142:2014+A1:2019: 'Methods for rating and assessing industrial and commercial sound'.

Ref 7-6 Control of Pollution Act 1974 (c. 40). Available online: https://www.legislation.gov.uk/ukpga/1974/40.

Ref 7-7 Department for Environment, Food and Rural Affairs (Defra). (2010). Noise Policy Statement for England.

Ref 7-8 Department for Transport (DfT). (2012). National Policy Statement for Ports.

Ref 7-9 Department of Transport (DfT)/ Welsh Office. (1998). Calculation of Road Traffic Noise.

Ref 7-10 European Commission (2002). Directive 2002/49/EC Environmental Noise Directive -END.

Ref 7-11 Extrium, England Noise and Air Quality Viewer

Ref 7-12 Highways England. (2020). Design Manual for Roads and Bridges LA111 Noise and vibration – Version 2.

Ref 7-13 Institute of Environmental Management and Assessment (IEMA). (2014). Guidelines for Environmental Noise Impact Assessment.

Ref 7-14 International Standards Organization (Part 1: 1993, Part 2: 1996) ISO 9613 – Acoustics – Attenuation of sound during propagation outdoors, ISO.

Ref 7-15 Ministry of Housing, Communities and Local Government (MHCLG). (2019). Planning Practice Guidance.

Ref 7-16 Ministry of Housing, Communities and Local Government (MHCLG). (2021). National Planning Policy Framework.

Ref 7-17 North East Lincolnshire Council. (2018). North East Lincolnshire Local Plan.

Ref 7-18 North Lincolnshire Council (2016) North Lincolnshire Council Planning for Health and Wellbeing-Supplementary Planning Document.

Ref 7-19 Secretary of State, H. M. Government (2006, as amended). The Environmental Noise (England) Regulations 2006. Statutory Instrument 2006 No. 2238.

Ref 7-20 UK Government (1990) The Environmental Protection Act 1990 (c. 43).

Ref 7-21 TRL (2006) Method for converting the UK road traffic noise index $L_{A10,18h}$ to the ES noise indices for road noise mapping.

Ref 7-22 British Standards Institute (1993) BS 7385-2: 1993 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from ground borne vibration'.

Ref 7-23 International Organization for Standardization (ISO) (2010) ISO 4866:2010.

Ref 7-24 Highways Agency (2011) Design Manual for Roads and Bridges Volume 11 Section 2 Part 7 (HD 213/11) Noise and vibration.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 8: Nature Conservation (Terrestrial Ecology)

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 8: Nature Conservation (Terrestrial Ecology)

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

8 Nature Conservation (Terrestrial Ecology)

8.1 Introduction

8.1.1 This chapter presents the findings of the assessment of the likely effects of the Project on nature conservation (terrestrial ecology).

8.1.2 The Project would be located partly within, and partly on land adjacent to, the Humber Estuary Special Area of Conservation ("SAC"), Special Protection Area ("SPA"), Ramsar site and Site of Special Scientific Interest ("SSSI"), collectively referred to as the Humber Estuary European Marine Site ("EMS"). All effects on the designated features of the Humber Estuary EMS are assessed in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and **Chapter 10: Ornithology [TR030008/APP/6.2]** respectively, and therefore this chapter does not include an assessment of the impacts of the Project on the Humber Estuary EMS.

8.1.3 The interrelationships related to the potential effects on terrestrial ecology and other disciplines are addressed in the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 6: Air Quality**: this chapter assesses potential interactions between the Project and the designated habitats of the Humber Estuary EMS arising from changes in air quality.

b. **Chapter 7: Noise and Vibration**: this chapter assesses potential interactions between the Project and the designated features of the Humber Estuary EMS that are sensitive to noise and vibration.

c. **Chapter 9: Nature Conservation (Marine Ecology**): this chapter assesses potential interactions between the Project and the designated marine and intertidal habitat features of the Humber Estuary EMS.

d. **Chapter 10: Ornithology**: this chapter assesses impacts on the qualifying bird interest of the Humber Estuary SPA/Ramsar and SSSI, including marine, coastal and supporting terrestrial habitats (i.e. functionally linked land). The assessment considers passage, overwintering and breeding bird species (including non-SPA/Ramsar breeding birds).

8.1.4 This chapter is also supported by the following appendices **[TR030008/APP/6.4]**:

a. **Appendix 8.A:** Ecological Impact Assessment Methods.

b. **Appendix 8.B:** Preliminary Ecological Appraisal Report.

c. **Appendix 8.C:** Bat Survey Report.

d. **Appendix 8.D**: Water Vole and Otter Survey Report.

e. **Appendix 8.E**: Great Crested Newt Survey Report.

f. **Appendix 8.F:** Draft Protected Species Licences.

g. **Appendix 8.G:** Arboricultural Impact Assessment.

8.2 Consultation and Engagement

8.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the nature conservation (terrestrial ecology) assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on nature conservation (terrestrial ecology). A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

8.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

8.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

8.2.4 The consultation undertaken with statutory consultees to inform this chapter, including those comments relevant to terrestrial ecology, raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation, is summarised, in **Table 8-1**. The full responses to consultation comments are included within the **Summary of Consultation Responses** document **[TR030008/APP/5.1]**.

8.2.5 Following receipt of the **Scoping Opinion** (**Appendix 1.B [TR030008/APP/6.4]**), the following requirements identified by the Planning Inspectorate have been considered as part of this assessment:

a. Evidence-based assessment of potential impacts on bats and their roosts is required: to address this requirement, further surveys have been undertaken and the results are reported in **Appendix 8.C [TR030008/APP/6.4]** and are summarised in this chapter.

b. Reptiles can be scoped out of the assessment provided that precautionary working methods are specified and committed: this approach has been followed in this chapter.

c. Further information on habitat suitability for white-clawed crayfish (*Austropotamobius pallipes*) in support of the case for scoping this species out of the assessment: to address this requirement, further information is provided in **Appendix 8.B [TR030008/APP/6.4]**.

d. All relevant statutory nature conservation designations are to be identified with reference to the Impact Risk Zones ("IRZs") (defined by Natural England): the IRZs defined by Natural England have been used to define the statutory nature conservation designations in this chapter.

Table 8-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes to scope out further surveys for bat foraging and commuting activity at the West Site due to the prevalence of low quality or unsuitable habitat and because usage would likely be on an occasional and transient basis by small numbers of foraging/ commuting common species of bats. In light of the evidence provided in Appendix C, the Inspectorate agrees that further bat surveys can be scoped out for the West Site only.	No further comment required.
		The Scoping Report notes there are a large number of mature oak and ash trees within Long Strip woodland (Pipeline area) that maybe suitable for roosting bats, but it assumes that all mature trees would be avoided by the Proposed Development. It states that should it become necessary to remove/ prune any mature trees, further assessment work for bats would be undertaken to inform mitigation/ licensing requirements as necessary. The Inspectorate does not agree that this matter can be scoped out at this time. Suitable trees should be evaluated for their roosting potential and this information should be used to inform design development and the assessment of effects. Should substantial bat populations be identified the potential for impacts on foraging/commuting would need to be revisited.	An assessment of roosting potential of suitable trees for bat roosts has been undertaken as well as emergence surveys of possible roosts and this is reported in this chapter in **Section 8.6** below. Emergence surveys are ongoing for a number of trees that were identified as having bat roost potential, and the surveys are due to be completed by the end of August or early September (weather dependent). A worst-case scenario has been assessed in the Chapter informed by the results of the bat activity surveys undertaken to date. The full results of these surveys will be submitted into the Examination at the first opportunity.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The Scoping Report states that none of the habitats within the Proposed Development's DCO site boundary have been found to be suitable for reptiles, as they lack the diverse habitat mosaic and varied topography favoured by species of reptiles for basking, refuge and hibernation and adds that in context with the lack of known reptile populations in this part of the county, it is reasonable to conclude that they are likely absent. The Scoping Report also states that the low risk of presence of grass snake on the main drain at the foot of the flood embankment can be addressed through a precautionary approach/ method statement for vegetation clearance during construction. The Inspectorate agrees that this matter can be scoped out of the assessment on this basis. The ES should set out the relevant precautionary working methods proposed to be adopted.	There have been minor changes to the Site Boundary since the submission of the EIA Scoping Report. None of the additional areas introduced into the Site Boundary are suitable for reptiles. Precautionary working methods for reptiles are defined in the **Outline Construction Environment Management Plan** ("Outline CEMP") for the Project **[TR030008/APP/6.5]** and these working methods are outlined in **Section 8.7** below.
		The Inspectorate agrees that Direct impacts on Local Wildlife Sites (LWS) during construction and decommissioning can be scoped out on the basis that there are no locally designated sites that would be directly impacted by the project construction activities.	No further comment required.
		Impacts on designated marine ecology features would be assessed in accordance with ES Chapter 8 and impacts on designated ornithology features would be assessed in accordance with Chapter 9. The Inspectorate agrees that this matter can be	The impacts on marine ecological receptors (other than birds) and on birds are assessed in **Chapter 9 Nature Conservation (Marine Ecology)** and **Chapter 10: Ornithology [TR030008/APP/6.2]** respectively.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		scoped from terrestrial ecology assessment on the basis that no impacts are anticipated on the Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI), collectively referred to as the Humber EMS, and as impacts on marine ecology and ornithology for these designated sites will be assessed elsewhere in the ES.	
		The preliminary ecological appraisal (Appendix C of the Scoping Report) states that ditches within the Proposed Development site boundary are unsuitable for white-clawed crayfish and therefore the species will not be considered further. The appraisal appears to relate only to the West Site of the Proposed Development site. The Inspectorate agrees that this matter may be scoped out for the West site but does not agree that this matter can be scoped out for the other parts of the site unless evidence demonstrating that ditches are unsuitable for white-clawed crayfish is provided for the other parts of the Proposed Development site in the ES or information which demonstrates agreement with the relevant consultation bodies and the absence of a likely significant effect.	The Preliminary Ecological Appraisal ("PEA") has been updated and is appended at **Appendix 8.B [TR030008/APP/6.4]**. All areas of the site, including the ditch network have been included within the appraisal. The appraisal concludes that the ditch network is unsuitable for white-clawed crayfish.
		The Scoping Report considers the Humber Estuary Site of Special Scientific Interest (SSSI) may be affected by the Proposed Development but does not explicitly refer to other SSSIs or SSSI impact risk zones. The Inspectorate advises that all relevant SSSI designated sites and impact risk zones should	North Killingholme Haven Pits SSSI, as a saline lagoon connected to the European Marine Site, falls within the potential scope of **Chapter 9: Nature Conservation (Marine Ecology) and Chapter 10: Ornithology [TR030008/APP/6.2].** It is not designated for features of relevance to the terrestrial

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		be considered in the assessment (including North Killingholme Haven Pits SSSI and The Lagoons SSSI) and evidence which demonstrates that the Proposed Development is unlikely to have any significant adverse effects on these should be provided in the ES.	ecology chapter. The Lagoons SSSI is located at distance from the Project (north of the Humber), the outer IRZ band extends to c. 9.9km from the SSSI so the nearest terrestrial part of Order Limits (c. 19km from the SSSI) is not located within its IRZ. On this basis, all relevant SSSIs have been considered and additional SSSIs are not discussed further in this chapter, **Chapter 8: Terrestrial Ecology [TR030008/APP/6.2].**
	Natural England	We note and welcome the report's consideration of impacts upon local wildlife and geological sites. Local Sites are identified by the local wildlife trust, geoconservation group or a local forum established for the purposes of identifying and selecting local sites. They are of county importance for wildlife or geodiversity. We welcome the report's inclusion of an assessment of the likely impacts on the wildlife and geodiversity interests of such sites. Further information on local wildlife Sites is available from the Yorkshire Wildlife Trust - 01904659570 or Email: info@ywt.org.uk. The ES should set out proposals for mitigation of any impacts and if appropriate, compensation measures and opportunities for enhancement and improving connectivity with wider ecological networks. They may also provide opportunities for delivering beneficial environmental outcomes.	The assessment in this chapter has not identified the potential for any significant effects on Local Wildlife Sites. Geological sites are outside the remit of a terrestrial ecological impact assessment but would be considered in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** if any were present.
	North East Lincolnshire Council	The site appears to be adjacent to W2 of North East Lincolnshire Borough Council No. 107 (Long Wood, Laporte Road, Stallingborough) Tree Preservation	The potential impact of the Project on the Tree Preservation Order (“TPO”) woodland is assessed in this chapter in **Section 8.6** below and an

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Order 2002. There is a defined drainage ditch between the site and the woodland. I am aware that this site is managed by the Humber Nature Partnership and that there is a management plan in place. Given the woodland is covered by a TPO I feel the impact of the proposal on the woodland should be considered within the EIA.	Arboricultural Impact Assessment, which covers the impacts of the Project on the TPO woodland is provided at **Appendix 8.G [TR030008/APP/6.4].**
Statutory Consultation January 2023	Humber Conservation	Please can you tell me the provisions that will be made to protect Longstrip Wood and public footpath	The pipeline corridor connecting the East Site to the jetty and the jetty access road, which comprise Work No. 2, would be situated within the Long Strip woodland belt. Through an iterative design process, the Applicant has sought to minimise loss of the trees and in particular to ensure the protection of a veteran tree within this area. Part of the Long Strip, including the veteran tree, would be retained as shown in Annex A of **Appendix 8.F [TR030008/APP/6.4]**. Approximately 0.64ha of woodland will be removed from the Long Strip woodland. The loss of part of the woodland from Long Strip is fully assessed in the Arboricultural Impact Assessment at **Appendix 8.G [TR030008/APP/6.4]** and in this chapter Environmental Statement ("ES") **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2] in Section 8.8** as well as **ES Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]**. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. Further details are provided at **Section 8.7** of this chapter. An **Outline Landscape and Ecology Management Plan** ("Outline LEMP") has been prepared to support the Application **[TR030008/APP/6.9]**. The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. The right of way through Long Strip comprises Bridleway 36 and the stretch from Laporte Road to the sea wall will be temporarily diverted during Phase 1. This is to enable the construction of works in this area and the use of the temporary construction area on the arable field to the east. Bridleway 36 would be re-opened on its existing alignment after first phase of construction. This is described in **ES Chapter 2: The Scheme [TR030008/APP/6.2]** and the impacts on users of the Bridleway are assessed in **ES Chapter 23: Socio-economics [TR030008/APP/6.2].**
		What steps will be taken to protect Long Strip Wood (250 years old at least) and public footpath NELC BW36 (potential part of east coast path)	The response in the row above addresses these points.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Forestry Commission	Direct impacts of development that could result in the loss or deterioration of ancient woodland or ancient and veteran trees include: · Damaging or destroying all/part of them (including their soils, ground flora or fungi) · Damaging roots and understory · Damaging or compacting soil around tree roots · Polluting the ground and watercourses around them · Changing the water table or drainage of woodland or individual trees · Damaging archaeological features of heritage assets It is therefore essential that the ancient woodland identified is considered appropriately to avoid the above impacts.	None of the woodland within the Site is listed on the Ancient Woodland Inventory ("AWI"). The assessment presented in this chapter refers to the woodland as 'Long Established Woodland' as identified in the Forestry Commission guidance.
		The Forestry Commission has prepared joint standing advice with Natural England on ancient woodland and veteran trees which we refer you to as it notes that ancient woodland is an irreplaceable habitat, and that, in planning decisions, Plantations on Ancient Woodland Sites (PAWS) should be treated equally in terms of the protection afforded to ancient woodland. It highlights the Ancient Woodland Inventory to find out if woodland is ancient. We also particularly refer you to further technical information set out in Natural England and Forestry Commission's Standing Advice on Ancient	None of the woodland within the Site is listed on the AWI. The other areas of non-ancient woodland have been added to the assessment and the impact of the Project on these areas is set out in **Section 8.8** of this chapter. A single veteran ash tree was located in the TPO woodland of the Long Strip during arboricultural surveys (see **Arboricultural Impact Assessment** at **Appendix 8.G [TR030008/APP/6.4]** for full details). This veteran tree would be retained and protected during construction to ensure there is no accidental damage to it. The route of the jetty access road and pipe-rack and the associated

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Woodland – plus supporting Assessment Guide and Case Decisions. We would be keen to highlight the buffering guidance for Ancient Woodland as highlighted in the Standing Advice indicated above. It is also worth noting that there are several other areas of non-ancient woodland that could be affected also by the proposed development. If you would like individual feedback on sites with Forestry Commission Incentives and Regulatory agreements throughout the entire proposed site, please feel free to contact the Forestry Commission as there may existing obligations on the land in respect to proposed new woodland creation.	buildings, which comprise **Work No. 2,** have been designed to ensure this tree can be retained, as explained further in **ES Chapter 3: Need and Alternatives [TR030008/APP/6.2]**.
		As stated in chapter 8.6.8 of the PEI Report, the woodland to be potentially affected by the proposed development “Long Strip Woodland” has a TPO designation on it and that there is evidence of the woodland being in existence for a long period of time and its loss cannot be easily replaced with an equivalent area of newly planted saplings in an alternative location. We therefore recommend that this woodland is treated as Long Established Woodland. The Forestry Commission is aware of the very low woodland cover in this area, which is also picked up in your documents. We would be keen to see an increase in woodland cover in this area and therefore keen to understand any	Some of the Long Strip woodland will be permanently lost and this is assessed in this chapter. The assessment presented in this chapter refers considers the Long Strip woodland as 'Long Established Woodland' as identified in the Forestry Commission guidance. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. Further details are provided at **Section 8.7** of this chapter.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		mitigation/compensation measures that are developed. The Forestry Commission has information on existing woodland creation schemes in the area including spatial data on where woodland would be best created. We recommend a management plan is developed for ongoing management of any new established woodland sites, and that management is considered in relation to neighbouring or other existing established woodland in the local landscape.	
	Lincolnshire Wildlife Trust	One of our main concerns is the impact/loss of TPO protected and irreplaceable woodland within the Long Strip Wood. Because of the woods' naturalness – consisting almost entirely of native trees and shrubs appropriate to the area – the site has potential to be classified as Lowland Mixed Deciduous Woodland Priority Habitat. Furthermore, white-letter hairstreak Satyrium w-album, a Priority Species, has been recorded on site between at least 2003 and 2020. Given its age, rarity and significance, the Long Strip Wood is considered by LWT to be irreplaceable and invaluable to local biodiversity and heritage. LWT would urge the developers to make further efforts to avoid 'predicted loss of woodland' within the Long Strip Wood following the mitigation hierarchy. While we understand the scale of woodland loss is unknown at the present time, we are concerned that 'it is expected to be a large part of the woodland'. Currently, we do not find this acquiescence to remove such a large area of irreplaceable woodland	The woodland is considered as UK Priority Habitat and Long Established Woodland in this chapter. Consultation with North East Lincolnshire Council ("NELC") regarding appropriate compensation for woodland loss is ongoing. Further details are provided below at **Section 8.7**. No requirement for further terrestrial invertebrate surveys has been identified, since relevant species are not specifically protected and appropriate enhancement of retained woodland, as well as compensatory woodland planting, will maintain habitat availability for invertebrates. This chapter acknowledges the recorded presence of white-letter hairstreak within the woodland. However, further survey for this species is not merited since its presence has already been confirmed. Justification for scoping out terrestrial invertebrate surveys is set out in **Appendix 8.B** (**Preliminary Ecological Appraisal Report**) **[TR030008/APP/6.4]**. White-letter hairstreak is dependent on the presence of

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		to be acceptable. There should be more efforts to avoid this impact in the design of the development. Were losses to the Long Strip Wood deemed to indeed be unavoidable following the mitigation hierarchy, LWT would expect commitments that go well beyond 'appropriate mitigation/compensation' to be put forward. This would need to include a significant effort and commitment to mitigating impacts and losses to this site, as well as a minimum delivery of 10% Biodiversity Net Gain – with encouragement from LWT to aim for targets beyond the minimum 10%. Given that recent surveys at Long Strip Wood found evidence of white-letter hairstreak, LWT would recommend that terrestrial invertebrates be scoped into further assessments.	elms and while some elms will be removed in association with Work No 2, some elms would also be retained. As a nationally significant infrastructure project ("NSIP"), the Project is not subject to the requirement to deliver 10% biodiversity net gain ("BNG") under The Environment Act 2021, as the requirement is yet to come into practical effect. Biodiversity Net Gain calculations are therefore not mandatory for NSIPs and have not been undertaken. An **Outline LEMP** has been prepared to support the Application **[TR030008/APP/6.9]**. The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. Further details are provided at **Section 8.7** of this chapter.
	North East Lincolnshire Council	The applicants have been working with NELC Trees and Landscape to look at initial high level issues; · The site meeting with the applicant on 14th December 2022 was constructive regarding the	The extent of tree removal is presented in the Arboricultural Impact Assessment at **Appendix 8.G [TR030008/APP/6.4]**. Consultation with NELC regarding appropriate compensation for woodland

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		ground investigation works required within the Long Strip Plantation; · I am yet to receive any information, plans works specifications, detailing the works outlined at the above meeting; · I am conscious that the construction of the above ground pipeline will likely result in further tree removal, this was not fully addressed at the aforementioned meeting. I look forward to further consultation regarding the extent of tree removal required to implement the scheme · Regarding the issue of tree removal, both that required for the ground investigation works as well as along the route of the pipeline, I will expect this to be ameliorated via a landscape proposal. I welcome further discussion on the detail of this point.	loss is ongoing. Further details are provided below at **Section 8.7**. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. Further details are provided at **Section 8.7** of this chapter.
	Local Resident (living within approx. 10km of the project)	I am a little concerned about an area we call the woods which goes up to bay 30 on the wall. Are you going to use this area as a construction site and what access road will you be using.	The route of the jetty access road and pipe-rack and the associated buildings, which comprise **Work No. 2,** have been designed to minimise the impacts on the Long Strip woodland and to ensure a veteran tree can be retained as explained further in **ES Chapter 3: Need and Alternatives [TR030008/APP/6.2]**. The majority of the woodland within the Long Strip would be retained.
	DFDS Seaways	The value of the ecological enhancements proposed for the IERRT have not been made clear and	The proposed Immingham Eastern Ro-Ro Terminal ("IERRT") ecological enhancements are set out in the woodland enhancement plan document submitted as part of the IERRT application,

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		nothing has been further suggested in assessing the cumulative effect of both projects.	compliance with which is a draft Development Consent Order ("DCO") Requirement for that scheme. The area of woodland subject to the enhancements associated with the IERRT proposals, which relate to that part of the Long Strip woodland south of Laporte Road, will not be impacted by the IGET scheme, other than by way of the temporary removal of informal access in this area, which is explained in **ES Chapter 2: The Project [TR030008/APP/6.2]**. The cumulative effects of IERRT and IGET are covered in **ES Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**. There are not expected to be any cumulative effects arising in relation to nature conservation (terrestrial ecology), arising from landside impacts of both projects.
Second Statutory Consultation May 2023 – July 2023	Lincolnshire Wildlife Trust	**Impacts to Long Strip Wood** While changes have been made to the routing of the Pipe Rack and jetty access road (Change No. 3), the revised design, which includes a proposed access road carriageway, proposed footway and proposed pipe rack, is estimated to result in the direct loss of roughly 36% of the Long Strip Wood (estimated from Plate 6.2 using QGIS Georeferencer). These proposed changes are described by the Applicant as benefiting the Long Wood by avoiding the 'highest value tree in the TPO', a single veteran ash tree in the north east corner of the woodland. However, the Applicant	The route of the jetty access road and pipe-rack and the associated buildings, which comprise **Work No. 2,** have been designed to minimise the impacts on the Long Strip woodland and to ensure a veteran tree can be retained as explained further in **ES Chapter 3: Need and Alternatives [TR030008/APP/6.2]**. The majority of the woodland within the Long Strip would be retained.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		acknowledges that several of the remaining trees distributed throughout the Long Strip Wood are of 'high and moderate quality'.	
		In addition to the direct loss of moderate to high value trees, LWT would argue that the indirect, negative effects on this habitat and its inhabitants would likely be much greater due to several short-term (e.g., displacement through construction related activities) and long-term impacts (e.g., noise and pollution from prolonged road use and operational maintenance), and based on the extent and nature of the proposed development.	The permanent loss of woodland and indirect effects on retained woodland are acknowledged and assessed in **Paragraphs 8.8.6 – 8.8.9**. The impact is assessed as moderate adverse (significant). An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. Further details are provided at **Section 8.7** of this chapter. It is acknowledged in **Paragraph 8.8.9** of this ES Chapter that this would require a longer timeframe than then 25-year operational life of the landside elements of the Project.
		In Section 6.4.4, the Applicant quotes the PEIR which states that, 'In order to mitigate for tree loss from the Long Strip and elsewhere, the following approach is proposed: Tree planting within some peripheral areas around the operational sites of the hydrogen facility, although these opportunities will be very limited; and	As stated above, the route of the jetty access road and pipe-rack and the associated buildings, which comprise **Work No. 2,** have been designed to minimise the impacts on the Long Strip woodland. However, this woodland cannot be avoided by the Project, and this is explained further in **ES Chapter 3: Need and Alternatives [TR030008/APP/6.2]**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Opportunities to be explored for potential off-site tree-planting within areas to be agreed with local bodies/organisations' LWT would like to point out that the Applicant has provided two examples of non-localised compensation, rather than mitigation. Therefore, further due diligence towards the mitigation hierarchy is recommended, and the above examples should be considered last resorts, according to best practice. Simply put, this particular woodland is considered irreplaceable and invaluable to local biodiversity and heritage, thus avoidance and mitigation should be emphasised, and the suggested compensation is likely to be unequal to the negative consequences of the projected habitat loss.	
		While it is clear that efforts have been made to address concerns for the impacts to the Long Strip Wood (e.g., Pipe Rack and jetty access road redesign), LWT believes that the current revisions fall short for delivering on assurances of minimal impact to the Long Strip Wood and due diligence according to the mitigation hierarchy. At this time, our stance remains the same and we will continue to monitor developments regarding impacts to the Long Strip Wood going forward.	This stance is noted.
		Biodiversity Net Gain	It is anticipated the secondary legislation mandating the need for 10% net gain will be in place by November 2023 for development within the Town &

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		LWT is disappointed that the updated documents for the Second Statutory Consultation continue to neglect Biodiversity Net Gain (BNG). Therefore, our stance remains the same. LWT would encourage the Applicant to include BNG in the planning and delivery of this project, and we would also encourage separate terrestrial and marine BNG delivery. Lastly, LWT would strongly suggest that mitigation/compensation for impacts to the Long Strip Wood are considered separate and additional to any BNG measures.	Country Planning Act, and November 2025 for NSIPs. Current guidance indicates that NSIPs accepted for examination before the specified commencement date would not be required to deliver mandatory biodiversity net gain, and therefore formal calculations using the Department for Environment, Food & Rural Affairs ("DEFRA") metric have not been undertaken for the Project. However, a qualitative approach to biodiversity enhancements will be taken and the following commitments are made within the ES: 1) An **Outline Landscape and Ecology Management Plan (OLEMP) [TR030008/APP/6.9]** has been prepared to support the Application. The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. The delivery and management of these areas will be incorporated into a Landscape and Ecology Management Plan ("LEMP"), prepared in accordance with the OLEMP and which will be secured by way of a DCO Requirement. 2) An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Natural England	**Change No. 3 - Routing of pipe rack & Jetty Access Road in Long Strip woodland** Natural England highlights the advice in our previous response (dated 16th March) 'tree works are proposed in Long Strip plantation, an assessment is needed to explain whether these works will impact on birds using the adjacent fields (if this field is still being used by birds during the tree works)'. Natural England highlights that the area of woodland proposed to be removed is priority habitat (deciduous woodland) and therefore support the commitment from the applicant to submit a 'Woodland compensation strategy' as part of the DCO, if there are no other options that avoid works within this area. Natural England would advise that prospective tree planting sites in the local area should be assessed to ensure that there is no conflict with areas that provide supporting habitat to Humber Estuary SPA bird populations.	Ornithology surveys have concluded that the land adjacent to Long Strip plantation (**Work No. 9**) is not functionally linked to the Humber Estuary SPA/ Ramsar (see **ES Chapter 10: Ornithology**) **[TR030008/APP/6.4]**. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated.
		Change No. 7 - Public Rights of Way Diversion (Public Bridleway 36) and stopping up of any informal access in two areas Natural England welcomes that any potential mitigation measures required in respect of water voles or otters will be reported in the ES.	Water vole is confirmed present within one ditch within the Proposed Development boundary and displacement works will be undertaken under a Class Licence approach, under the supervision of an ecologist registered to use a Natural England Class Licence for water vole.

8.3 Legislation, Planning Policy and Guidance

8.3.1 **Table 8-2** presents a summary of the legislation, policy and guidance relevant to the nature conservation (terrestrial ecology) assessment and details how their requirements will be met by the Project.

Table 8-2: Relevant Legislation, Policy and Guidance Regarding Nature Conservation (Terrestrial Ecology)

Legislation/Policy/Guidance	Consideration within the ES Chapter
The Conservation of Habitats and Species Regulations *2017 (as amended)* (Ref 8-1)	
The Regulations provide for the protection of 'European sites' and the protection of 'European protected species'. The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4. However, these actions can be made lawful through the granting of licences by the appropriate authorities. The Regulations require competent authorities to consider or review applications for planning permission/ consents for projects through an appropriate assessment of the plan/ project.	**Section 8.6** identifies European Sites and European Protected Species relevant to this assessment. **Section 8.7** summarises how these have been addressed in the Project design. **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and any related requirements for avoidance/mitigation/ compensation measures. Assessment in respect of the Humber Estuary EMS and its designated features is considered in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and the ornithological features of the Humber Estuary SPA/Ramsar and SSSI in **Chapter 10: Ornithology.** The information to inform an appropriate assessment is presented in **the Shadow Habitats Regulations Assessment [TR030008/APP/7.6]**
Wildlife and Countryside Act ("WCA") 1981 (as amended) (Ref 8-2)	
Part 1 of the WCA affords general protection to all species of wild bird, and specific protection to flora and fauna listed in Schedules 1 (birds protected by special penalties), 5 (other animals), and 8 (flora, fungi and lichens). In certain circumstances, licences can be granted to permit some actions prohibited under the Act. Schedule 9 provides lists of non-native flora and fauna that it is an offence to release or cause to spread in the wild. Of primary relevance in the context of proposed developments are flora e.g. invasive non-native plant species. Part 2 of the WCA details the law regarding SSSI and other protected areas within Great Britain.	**Section 8.6** identifies SSSIs and protected species and invasive species relevant to this assessment. **Section 8.7** summarises how these have been addressed in the Project design. **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and any related requirements for avoidance/ mitigation/compensation measures.

Legislation/Policy/Guidance	Consideration within the ES Chapter
Natural Environment and Rural Communities ("NERC") Act 2006 (Ref 8-3) as amended by the Environment Act (2021)	
Through Section 40 of the Act, a legal duty is placed on Government Departments and public authorities to consider what action the authority can take, consistent with exercise of its functions, to further the general biodiversity objective, which is the conservation and enhancement of biodiversity in England. This 'biodiversity duty' includes, but is not restricted to, habitats and species of principal importance for nature conservation in England published by the Government in accordance with the requirement set through Section 41 of the Act.	**Section 8.6** identifies important habitats and species relevant to this assessment including those identified in Section 41 of the Act. **Section 8.7** summarises how these have been addressed in the Project design. **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and any related requirements for avoidance/ mitigation/ compensation measures.
Protection of Badgers Act 1992 (Ref 8-4)	
This Act makes it an offence to kill or take a badger, to cruelly ill-treat a badger, or to interfere with a badger sett, including disturbing a badger while it is occupying a sett. In certain circumstances, licences can be granted to permit some actions prohibited under the Act.	Surveys have been completed to identify if badgers are likely to be affected. **Section 8.6** confirms this species has not been recorded during recent surveys and so no disturbance to badgers is anticipated.
The Hedgerow Regulations 1997 (Ref 8-5)	
The regulations do not apply to acts of hedgerow removal covered by the grant of planning permission. However, the regulations retain value as part of the process for determining the relative value of specific hedgerows/ hedgerow networks and requirements for appropriate mitigation.	Surveys have been completed to identify locations where hedgerows are located and their importance has been evaluated (see **Section 8.6**). No 'important' hedgerows have been identified within the Site Boundary and therefore this legislation is not relevant to the Project.
Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 8-6)	
The Order allows for the enforcement of European Union Regulation No. 1143/2014 on the prevention and management of the introduction and spread of invasive alien species within England. The Regulation lists species of European Union concern which cannot be imported, kept, bred/ grown, transported, sold, used, allowed to reproduce, or released into the environment. The Order therefore tightens existing rules (e.g. under the Wildlife and Countryside Act 1981) around releasing invasive non-native animals which threaten our native wildlife.	Surveys have been completed to identify if any terrestrial invasive non-native plant species are present on the Site. **Section 8.6** confirms that there are no known occurrences of invasive non-native plant species within the Site. The potential for future occurrence of invasive non-native plants is addressed in the **Outline Landscape and Ecological Management Plan [TR030008/APP/6.9].**

Legislation/Policy/Guidance	Consideration within the ES Chapter
National Policy Statement for Ports 2012 ("NPSfP") (Ref 8-7)	
Section 4.8 requires the decision-maker to "consider whether a project may have a significant effect on a European site, or on any site to which the same protection is applied as a matter of policy, either alone or in combinations with other plans or projects." Section 5.1 (Biodiversity and geological conservation) provides the nature conservation framework for decisions on proposals for new port development. Section 5.1.4 states than "the applicant should ensure that the ES clearly sets out any effects on international, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and species identified as being of principal importance for the conservation of biodiversity." It states the policies to avoid and mitigate harmful aspects of development on International Sites (5.1.10), SSSI (5.1.11-5.1.12), Marine Conservation Zones (5.1.12), Regional and Local Sites (5.1.14) ancient woodland and veteran trees (5.1.15) and protected habitats and species (5.1.17-5.1.18). Section 5.1.19-5.1.20 require the mitigation measures to be shown.	In accordance with NPSfP Section 4.8, assessment in respect of the Humber Estuary EMS and its designated features is considered in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and the ornithological features of the Humber Estuary SPA/Ramsar and SSSI in **Chapter 10: Ornithology [TR030008/APP/6.2].** The information to inform an appropriate assessment is presented in the **Shadow Habitats Regulations Assessment [TR030008/APP/7.6]** In accordance with NPSfP section 5.1.4 – 5.1.18), **Section 8.6** of this chapter identifies all of the terrestrial designations, habitats and species relevant to this assessment, including the identification of a veteran tree present in the Long Strip woodland. Marine designations are addressed in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. **Section 8.8 - 8.10** provides an assessment of potential impacts and effects. In accordance with NPSfP section 5.1.19-20, **Section 8.7** shows avoidance and mitigation included in the design and **Section 8.9** summarises the mitigation and enhancement measures for terrestrial ecology and **Section 8.10** shows any residual effects.
National Planning Policy Framework ("NPPF") 2021 (Ref 8-9)	
Chapter 15 (*Conserving and enhancing the natural environment*) sets out government planning policies for England and how decision-making should contribute to and enhance the natural and local environment. Guidance to local planning authorities on determining planning applications is given in paragraph 180. Specifically, the following principles of relevance should be applied: a) if significant harm to biodiversity cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused. b) development on land within or outside a SSSI and which is likely to have an adverse effect on it should not normally be permitted. c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees)	**Section 8.6** identifies the SSSIs and biodiversity features relevant to this assessment. **Section 8.7** and **Section 8.9** summarise how the Project has incorporated measures to avoid significant harm (in accordance with NPPF 180a). Development adjacent to the Humber Estuary SSSI/SPA is considered in **Chapter 9: Nature Conservation (Marine Ecology)** and C**hapter 10: Ornithology** (in accordance with NPFF 180b). The Project avoids the loss of a veteran tree in Long Strip (not ancient woodland, described in **Section 8.6**), in accordance with NPFF 180c. **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and any related requirements for avoidance/mitigation/ compensation. Measures which have been integrated into the design (NPFF 180d) are summarised in **Section 8.7.** An **Outline Landscape and Ecology Management Plan (OLEMP)** has been prepared to support the Application **[TR030008/APP/6.9]**; The Outline LEMP defines the opportunities which are available within

Legislation/Policy/Guidance	Consideration within the ES Chapter
should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists. d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design.	the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated.
Government Standing Advice (Ref 8-10 and Ref 8-11)	
The purpose of standing advice is to guide decision-makers on the determination of proposals with potential to affect protected sites, habitats and species.	This advice has informed the overall survey and assessment approach in respect of protected species/habitats, which is set out in **Table 8-3** (field survey scopes and methods) and **Appendix 8.A [TR030008/APP/6.4]** (assessment scope and methods).
Local Policy	
North East Lincolnshire Local Plan 2018 (Ref 8-21)	
Policy 9 – Habitat Mitigation – South Humber Bank. This policy requires proposals within the Mitigation Zone, which will adversely affect the Humber Estuary SPA / Ramsar site due to loss of functionally linked land, to provide their own mitigation to comply with the requirements of the Habitats Regulations. Policy 41 – Biodiversity and Geodiversity. This policy sets out a strategic approach, which positively plans for the creation, protection, enhancement and management of sites of biodiversity and geodiversity value.	The Project is located within the Mitigation Zone[1] identified on the policies map and therefore falls within the remit of this policy where land that is functionally linked to the Humber Estuary SPA/ Ramsar site is lost to development. The relevant terrestrial habitats are identified in **Section 8.6**, but the impact assessment is covered in **Chapter 10: Ornithology [TR030008/APP/6.2]** given the relevant qualifying interest features are birds. Surveys to determine whether land within the Site Boundary is functionally linked to the SPA/ Ramsar have been undertaken (the scope is covered in **Chapter 10: Ornithology [TR030008/APP/6.2]**). **Section 8.6** identifies the biodiversity features relevant to this assessment. **Section 8.7** summarises how these have been addressed in the Project design **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and

[1] Development proposals within the 'Mitigation Zone', which will adversely affect the Humber Estuary SPA / Ramsar site due to loss of functionally linked land, are required to provide their own mitigation to comply with the requirements of the Habitats Regulations.

Legislation/Policy/Guidance	Consideration within the ES Chapter
	any related requirements for avoidance/ mitigation/ compensation.
Lincolnshire Biodiversity Action Plan (Ref 8-12)	
Identifies biodiversity conservation objectives within the region and provides action plans for priority habitats, species, locally important wildlife and sites.	**Section 8.6** identifies the biodiversity action plan habitats and species relevant to this assessment. **Section 8.7** summarises how these have been addressed in the Project design **Sections 8.8 - 8.10** provide an assessment of potential impacts and effects, and any related requirements for avoidance/ mitigation/ compensation measures.
Keepers of time: ancient and native woodland and trees policy in England (2022) (Ref 8-19).	
The Government increased protection for ancient woodland and ancient and veteran trees in the planning system by amending the NPPF in 2012 and again in 2018, 2019 and 2021. The strategic objectives of this policy are to: • maintain and enhance the existing area of ancient woodland • conserve and enhance the existing resource of ancient and veteran trees • recognise the value of and protect long-established woodland The main priority is the protection of ancient woodland, and ancient and veteran trees; however, the policy recognises the value of long-established woodland and the need to protect this habitat from development.	None of the woodland within the Site is listed on the Ancient Woodland Inventory ("AWI"). The other areas of non-ancient woodland have been added the assessment (and are evaluated to be 'Long Established Woodland' based on Forestry Commission criteria) and the impact of the Project on these areas is set out in this chapter at **Section 8.6.** A single veteran ash tree was located in the TPO woodland of the Long Strip during arboricultural surveys (see **Arboricultural Impact Assessment** at **Appendix 8.G [TR030008/APP/6.4]** for full details). This veteran tree would be retained and protected during construction to ensure there is no accidental damage to it. The route of the jetty access road and pipe-rack and the associated buildings, which comprise **Work No. 2,** have been designed to ensure this tree can be retained as explained further in **ES Chapter 3: Need and Alternatives [TR030008/APP/6.2]**. An **Outline Landscape and Ecology Management Plan (OLEMP) [TR030008/APP/6.9]** has been prepared to support the Application; The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated.

8.4 Assessment Methodology

8.4.1 The assessment method for the Ecological Impact Assessment ("EcIA") contained in this chapter in order to identify likely significant effects is provided in **Appendix 8.A [TR030008/APP/6.4]** and remains as summarised in the Scoping Report.

Limitations and Assumptions

8.4.2 No limitations are considered to be relevant. Access was possible to all areas within the Site Boundary and weather was good during all survey visits. All relevant habitats and species have been addressed within the assessments in this chapter.

8.4.3 Works within Work No. 10 relate only to temporary street works associated with existing built infrastructure (e.g. street furniture, overhead lines) on Kings Road during the construction phase; as no semi-natural habitats are impacted by this work, and therefore there is no risk of protected species being present, all land within Work No. 10 has been excluded from the ecology survey area.

Use of the Rochdale Envelope

8.4.4 The Rochdale Envelope principle arises from United Kingdom ("UK") case law. It is an established principle that allows a number of parameters to be set to establish an envelope within which the Project would be delivered. Its adoption allows robust EIA to be undertaken by defining a reasonable worst-case scenario that decision-makers can consider when determining the acceptability or otherwise of the environmental effects of the Project. Further context on the use of the Rochdale Envelope approach is provide in **Chapter 5: EIA Process [TR030008/APP/6.2]**.

8.4.5 In ecological impact assessment this approach is aligned with the use of the precautionary principle. Best practice guidance from the Chartered Institute of Ecology and Environmental Management ("CIEEM") (Ref 8-20) states that "*the evaluation of significant effects should always be based on the best available scientific evidence proportionate to the severity of those effects…..In cases of reasonable doubt, where it is not possible to robustly justify a conclusion of no significant effects, mitigation/compensation measures should be applied in accordance with the precautionary principle. Where uncertainty exists, it must be acknowledges in the EcIA*."

8.4.6 The assessment of effects on terrestrial ecology takes a precautionary approach in its assumptions about zone of influence based on the parameters of the Project, the importance of ecological features and potential for adverse effects.

8.5 Study Areas

8.5.1 The following study areas are applicable to the nature conservation (terrestrial ecology) assessment:

a. Desk Study Area: defined as land within the Site Boundary and a 2km buffer for obtaining baseline data pertaining to terrestrial statutory and non-statutory designated sites, protected species and UK Priority habitats and species. The IRZs defined by Natural England have also been used to identify the

SSSIs of relevance to this assessment. This is extent is considered to be appropriate because it is likely to encompass any physical pathways which might impact offsite terrestrial ecological receptors and also include the home ranges or territories of any mobile protected species which may be using both onsite and off-site areas.

b. Habitat Survey Area: all terrestrial land within the Site Boundary (excluding the jetty) and up to 50m from the Site Boundary where accessible/visible from adjacent land. This includes permanent land take and temporary laydown areas. This extent is considered appropriate because it encompasses all habitats with the potential to be directly impacted, and any protected species the habitats may support.

c. Species Survey Areas: these were defined on a case -by-case basis (refer to **Table 8-3**) in accordance with the good practice survey guidelines for the species concerned and with consideration of the likely pathways for impact.

8.5.2 The potential zone of influence, as defined by the CIEEM guidance and outlined below, seeks to consider the potential distance from the activities being conducted to facilitate the construction (or operation) of the Project in which the designated sites, habitats or species present may be affected by those activities e.g. the terrestrial habitats within which great crested newt may disperse from a breeding pond. The study and survey areas were considered sufficient to collate ecological baseline data to inform an EcIA for the Project and to account for the potential effects likely to occur within the relevant zone of influence for each ecological feature.

Desk Study

8.5.3 A desk-based study was undertaken to obtain terrestrial ecology data from the following key sources:

a. Multi-Agency Geographical Information for the Countryside (“MAGIC”) website (Ref 8-13) for statutory designated sites and ancient woodlands within 2km of the Project.

b. Natural England website (Ref 8-14) for information on statutory designated sites of nature conservation interest within 2km of the Project and to confirm reasons for designation and site condition.

c. Natural England Priority Habitat Inventory for records of priority habitats within 2km of the Project (accessible via MAGIC, see above).

d. Lincolnshire Ecological Records Centre (“LERC”) for non-statutory designated sites and for records of protected and notable species within 2km of the Project.

e. Local authority planning portal for any potentially relevant ecological records pertaining to the Site Boundary and its immediate surrounds.

Field Surveys

8.5.4 The scope of field surveys undertaken is detailed in **Table 8-3**, along with references to the relevant methods and guidance adopted for each survey, and the dates of each survey. The relevant areas of the Site are defined in **Chapter**

2: The Project [TR030008/APP/6.2] and shown on **Figure 2.3 [TR030008/APP/6.3]**.

8.5.5 Phase 1 habitat and Phase 2 protected species surveys were undertaken in both 2022 and 2023 to reflect any impacts on the surveyed protected species made by the changes in the Site Boundary that occurred since the original PEA Report was prepared for the West Site (as submitted with the Scoping Report (**Appendix 8.B [TR030008/APP/6.4]**)). These surveys are summarised in **Table 8-3** below.

Table 8-3: Summary of Field Surveys undertaken in 2022/23

Survey	Field Survey Method	Field Survey Scope	Timing
Phase 1 habitat survey	Phase 1 Habitat Survey in accordance with the published method (Ref 8-16). Assessment of possible presence of protected, priority or otherwise notable species and, where relevant, the likely importance of habitat features for such species. Record of Invasive Non-Native Species (INNS) of plants. Incidental records of protected or priority species or their field signs.	• All habitats within the Site Boundary	March – June 2022 March – June 2023
Woodland ground flora survey	Walkover survey to record detailed botanical species listed within woodland habitats.	• Long Strip Woodland within Pipe Rack and Jetty Access Road site (Work No. 2) (see **Figure 2.4 [TR030008/APP/6.3]**	June 2022
Badger	Walkover survey to record any field signs of badger such as setts, latrines, or footprints.	• All habitats within the Site Boundary	March – June 2022 March – June 2023
Bats – foraging/ commuting	Monthly walked bat activity transects in suitable habitats in accordance with standard methods (Ref 8-17).	• Long Strip Woodland (Work No. 2) • East Site - Ammonia storage site (Work No. 3)	June, July, August and September 2022
	Monthly deployment of remote static bat detectors in suitable habitats for a minimum of five days per deployment.	• Long Strip Woodland (Work No. 2) • East Site - Ammonia Storage site (Work No. 3)	June, July, August and September 2022

Survey	Field Survey Method	Field Survey Scope	Timing
Bats – roosting	Potential Roost Features ("PRF") assessment in accordance with standard methods (Ref 8-17)	• All mature trees in Long Strip Woodland (Work No. 2)	February 2023
	Dusk emergence/dawn swarming surveys in accordance with standard methods (Ref 8-17)	• All trees identified with moderate or high bat roost potential during the PRF survey that will be removed for development (Work No. 2).	July – August 2023
Otter	Presence/absence survey for field signs.	• All ditches within Site Boundary.	October 2022
Water vole	Presence absence survey following standard methods (Ref 8-18).	• All ditches within the Site Boundary	May and October 2022
Great crested newt	Habitat Suitability Index ("HIS") assessment in accordance with standard methods (Ref 8-19).	• Ponds identified within 250m of Site Boundary, where accessible.	June 2023
	Environmental DNA ("eDNA") sampling.	• Ditch at the base of the flood embankment (Work No. 1).	June 2022
		• Pond 1 (within 250 m of Site Boundary).	June 2023
Terrestrial invertebrates	Habitat site appraisal by invertebrate specialist.	• West Site (Work No. 7) • East Site - Ammonia Storage site (Work No. 3) • Long Strip Woodland (Work No. 2)	June 2022

Field Surveys Scoped Out

8.5.6 As set out in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), surveys for the following species were scoped out:

a. **Bat foraging/commuting activity at the West Site (Work No. 7)**: the habitats comprise mainly open tall-swarded grassland with some areas of dense scrub. Given the open and exposed nature of the West Site, it is considered unlikely that the habitats would be used on anything other than an occasional and transient basis by small numbers of foraging/ commuting common species of bats. Further bat surveys of this habitat were therefore scoped out.

b. **Reptiles:** none of the habitats within the Site Boundary have been found to be suitable for reptiles, as they lack the diverse habitat mosaic and varied topography favoured by species of reptiles for basking, refuge and hibernation. The ditches are mainly dry and therefore unsuitable for grass snake, with the exception of the main drain at the foot of the flood embankment. When considered in context with the lack of known reptile populations in this part of Lincolnshire, it is reasonable to conclude that they are likely to be absent. The low risk of presence of grass snake on the main drain at the foot of the flood embankment would be addressed through a precautionary approach/ method statement for vegetation clearance during Project construction and included within the Final CEMP.

c. **White-clawed crayfish**: none of the ditches within the Site Boundary are suitable for this species. Most of the ditches dry out regularly, making them wholly unsuitable for white-clawed crayfish. Others are managed drains with poor potential for refuges and the drain near the coast has some brackish influence. Therefore, no further survey is needed as the species is likely to be absent.

8.6 Baseline Conditions

Current Baseline

8.6.1 A Phase 1 Habitat survey and preliminary ecological appraisal of land within the Site was undertaken in 2022 (see **Appendix 8.B [TR030008/APP/6.4]**). As the Project design has evolved throughout 2022 and 2023, the Phase 1 Habitat survey has been extended to ensure that all terrestrial areas within the Site Boundary (and within the relevant zones of influence) have been subject to an appropriate level of survey to inform this EcIA.

8.6.2 Ecological receptors are valued in accordance with the standard EcIA methodology as set out in **Appendix 8.A [TR030008/APP/6.4]**.

8.6.3 The following Phase 2 ecology surveys were undertaken to inform the EcIA, following the completion of preliminary ecological assessment work:

a. Woodland ground flora – reported in **PEA Report** (**Appendix 8.B [TR030008/APP/6.4]**).

b. Badger – reported in **PEA Report** (**Appendix 8.B [TR030008/APP/6.4]**).

c. Bats (foraging/commuting activity) - detailed method, scope and results reported in **Bat Survey Report** (**Appendix 8.C [TR030008/APP/6.4]**).

d. Bats (roosting) - detailed method, scope and results reported in **Bat Survey Report** (**Appendix 8.C [TR030008/APP/6.4]**).

e. Otter and water vole - detailed method, scope and results reported in **Otter and Water Vole Survey Report** (**Appendix 8.D [TR030008/APP/6.4]**).

f. Great crested newt eDNA" survey - detailed method, scope and results reported in **Great Crested Newt Survey Report** (**Appendix 8.E [TR030008/APP/6.4]**).

Statutory Designated Sites

8.6.4 There are no statutory designated sites with IRZ that overlap the Site Boundary and that have qualifying interest features of relevance to this terrestrial ecology assessment.

8.6.5 The marine elements of the Project (see **Chapter 2: The Project [TR030008/APP/6.2]**) are located within the Humber Estuary EMS which encompasses the Humber Estuary SPA, SAC, Ramsar and SSSI designations. The qualifying interest features (including subtidal and intertidal habitats, marine species and ornithology features) are outside the scope of this ES chapter. Given this, no further consideration is given to the Humber Estuary EMS in this chapter. Both the direct and indirect impacts on the designated habitats and features are instead considered within **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and **Chapter 10: Ornithology [TR030008/APP/6.2]**.

Non-statutory Designated Sites

8.6.6 The desk study identified one non-statutory designated site within 2km of the Project, namely the Laporte Road Brownfield Site Local Wildlife Site ("LWS") which is located approximately 150m south-east of the Site Boundary (the nearest part of which is the proposed temporary construction compound off Laporte Road, **Work No. 9**). This site is of County nature conservation value. No pathways by which this LWS could be affected by the Project have been identified and therefore no further consideration is given to it within this chapter.

Habitats

8.6.7 A summary of the habitats identified within the Habitat Survey Area is provided in **Table 8-4.**

8.6.8 Most habitats within the Habitat Survey Area are of low ecological value, with the exception of the mature broad-leaved deciduous woodland of Long Strip (within the Pipe Rack and Jetty Access Road site) as shown on **Figure 2 in Appendix 8.B (Preliminary Ecological Appraisal) [TR030008/APP/6.3]**. All habitats within the Habitat Survey Area except the woodland are therefore evaluated as being of Site nature conservation value only.

8.6.9 The woodland habitat within Long Strip is representative of the UK Priority Habitat type 'lowland mixed deciduous woodland' and the Local Biodiversity Action Plan ("BAP") habitat 'trees and woodland'. Lincolnshire is noted to be *'…one of the least wooded counties in Britain'* with the predominance of agricultural cultivation meaning that woodlands have become reduced in extent and fragmented throughout the county's landscape (Ref 8-13). The woodland is also subject to a TPO which applies to the whole woodland block (including the area on the south side of Laporte Road, which is outside the Site Boundary). Interrogation of freely available historic maps indicates that "Long Strip" woodland was present on the 1889 Ordnance Survey Map where it was a continuous strip of woodland (Laporte Road having not been constructed at that time). It is therefore likely that this area has been wooded from at least the middle of the 19th century, most likely planted as a shelterbelt. The Forestry Commission, in its response to the first statutory consultation on the Project

recommended that the woodland be treated as 'Long Established Woodland'[2] given that there is evidence of it having been in existence for a relatively long period of time. Given its rarity within the wider local area and the period of time for which the woodland has been established, but taking into account the fact that it is not subject to any local nature conservation designations (other than the TPO), this habitat is evaluated in this assessment as being 'Long Established Woodland' which is of Borough nature conservation value.

Table 8-4: Summary of Habitats within Habitat Survey Area

Habitat	Brief Description
Semi-improved grassland	The dominant habitat on the West Site (Work No. 7) having originated from three abandoned arable fields (abandoned from agricultural cultivation approximately ten years ago). The grassland comprises tall swarded poor semi-improved grassland and tall ruderals dominated by false oat-grass (*Arrhenatherum elatius*) with tall fescue (*Schedonorus arundinaceus*), tufted hair-grass (*Deschampsia cespitosa*) and meadow foxtail (*Alopecurus pratensis*).
Scrub	Self-seeded goat willow (*Salix caprea*) scrub has become established in the western and eastern parts of the West Site (Work No. 7). Dense areas of self-seeded silver birch (*Betula pendula*) and bramble are present around a central cleared area in the East Site (Work No. 3 and 5).
Hedgerow	The former arable field boundaries in the West Site (Work No. 7) are marked by overgrown species-poor hawthorn (*Crataegus monogyna*) hedgerows with parallel ditches choked with common reed (*Phragmites australis*).
Arable	The proposed Temporary Compound Area off Laporte Road (Work No. 9) would occupy a large arable field (approximately 15ha) fronting the estuary, which was under a wheat crop at the time of the Phase 1 Habitat survey in March 2022.
Hardstanding	Areas of hard-standing are scattered throughout the Survey Area and are associated with the existing port road network and land currently in use for port-related storage.
Broad-leaved woodland	The Pipe Rack and Jetty Access Road (Work No. 2) would be constructed within a narrow band of mature woodland on the north side of Laporte Road referred to as 'Long Strip'. The canopy is dominated by pedunculate oak (*Quercus robur*) and ash (*Fraxinus excelsior*), with an understorey of mature hawthorn, elder (*Sambucus nigra)* and some areas of denser bramble scrub. This habitat is representative of the UK Priority Habitat type 'lowland mixed deciduous woodland'.

[2] Definition of Long Established Woodland as set out in *Keepers of time: ancient and native woodland and trees policy in England* (2022) (Ref 8-19): "*Woodlands that have been on the Ordnance Survey Epoch 1 Map series since 1893 and have been wooded continuously until today. All ancient woodland is long established, however not all long-established woodland is ancient*".

Habitat	Brief Description
	This habitat would fall within the 'trees and woodland' Local BAP habitat type for which an action plan has been prepared. The woodland is not listed on the Ancient Woodland Inventory and the species recorded in the woodland were not indicators of ancient woodland, with only two species recorded from the LWS list of woodland indicator species (**Appendix 8.B, Annex E Table E3 [TR030008/APP/6.4]**). For the purposes of assessment it is considered to be 'Long Established Woodland' in accordance with Forestry Commission guidance.
Ephemeral/ short perennial	Part of the East Site – Ammonia Storage site (Work No. 3) has been in use for ad-hoc overflow parking and storage of construction arisings/equipment; the central area comprises crushed and levelled aggregate material that has become colonised with ephemeral/ short perennial vegetation. This habitat does not support a sufficiently diverse mosaic of species-rich areas, wetlands and varied topography to fall within the definition of the UK Priority Habitat type 'open mosaic habitat on previously developed land'. The habitat is also considered insufficiently diverse to meet the Local BAP definition of 'brownfield' habitat, although there are elements of the habitat that may be considered representative of this habitat type such as the bare ground/ loose substrates that are becoming colonized by vegetation.
Ditches	There are several ditches within the West Site (Work No. 7); some are of recent origin having been constructed approximately five years ago as part of development enabling works for access to the land off Kings Road. There are other ditches in the West Site (Work No. 7) associated with the overgrown hedgerows that formerly marked the field boundaries. All of the ditches are heavily overgrown with common reed and hold virtually no water. There is a drainage ditch that runs along the western boundary of Long Strip Woodland (Work No. 2), and which is culverted beneath Laporte Road. The stretch south of Laporte Road, and approximately three quarters of the ditch north of Laporte Road was dry when surveyed in Spring and supported no evidence of aquatic/marginal vegetation so is unlikely to regularly hold water. The northernmost section held some water but supported no vegetation due to substantial shading from shrubs on the banks. A large man-made drainage ditch is present at the base of the flood embankment (Work No. 1); this is regularly maintained by the Environment Agency. The ditch is approximately 5m wide and supports areas of dense common reed. North Beck Drain flows adjacent to the eastern boundary of the Temporary Compound Area off Laporte Road (Work No. 9).
Ponds	There are no ponds within the Site Boundary. Four ponds were identified through desk study as present within 250m of the Site Boundary. These are discussed in further detail below in respect of their potential to support great crested newt.

Badger

8.6.10 The desk study returned no records of badger from within the Desk Study Area.

8.6.11 No field signs indicating the presence of badger were found within the Site Boundary during surveys undertaken in 2022 or 2023. There is some potentially suitable habitat in grassland, woodland and areas of scrub for foraging and commuting badgers, but these habitats are not well connected to suitable habitat for badgers in the wider local area. Within the Site Boundary, the woodland habitat in Long Strip (Work No. 2) offers the highest potentially suitable habitat for badgers; however, the woodland is relatively heavily disturbed by pedestrians/ dog walkers (there is a public bridleway along the eastern edge of the woodland) with evidence of fly-tipping within the woodland area, and no signs of badger were found.

8.6.12 Limited vegetation clearance for Ground Investigation ("GI") work, related to the Project, was undertaken under the supervision of an Ecological Clerk of Works ("ECoW") in the East Site – Ammonia Storage site (Work No. 3) in winter 2022/23. No evidence of badger setts or badger activity on this part of the Site was uncovered in the areas cleared.

8.6.13 Although it is difficult to confirm the absence of this species, given that it is a common, widespread and wide-ranging mammal, but given the lack of desk study records and the lack of field evidence, the presence of badger on anything other than a transient and occasional basis within the Site Boundary is considered unlikely. This species is therefore not considered further in this assessment.

8.6.14 Precautionary mitigation would be implemented during the Project construction phase to address the low residual risk of encountering badger during vegetation clearance activities.

Bats

8.6.15 The desk study returned no records of bats from within the Desk Study Area.

8.6.16 Most habitats within the Site Boundary are of low quality for foraging/commuting bats due to the open nature of the land and the lack of botanical species diversity to provide large numbers of insect prey. These habitats were not scoped into the survey for foraging bats.

8.6.17 The woodland habitat in Long Strip (Work No. 2) offers the highest potential for suitable habitat for foraging and commuting bats; however, surveys completed to date have only recorded common pipistrelle (*Pipistrellus pipistrellus*) during both the walked transects and the static remote detector deployment periods. It is concluded that the relative isolation of the woodland habitat from other suitable areas of scrub/woodland in the wider local area due to the operational port and other industrial uses, results in low numbers of bats being present.

8.6.18 The walked transects also covered the young woodland/scrub habitat in the East Site – Ammonia Storage site (Work No. 3) due to its connectivity to Long Strip woodland, but again the surveys undertaken indicated the presence of only low numbers of common species of bat foraging/commuting within the habitats.

8.6.19 An assessment of Potential Roost Features ("PRFs") of all mature trees to be removed for development (see also **Appendix 8.F**) identified two trees with high bat roost potential and 16 with moderate bat roost potential, as well as one tree with a confirmed bat roost (T32; confirmed through the observed presence of bat droppings outside the tree cavity feature). These trees are undergoing further dusk emergence/dawn swarming surveys in accordance with standard methodology in summer 2023, and the surveys are due to be completed by the end of August/early September (weather dependent). However, based on the results of the transect surveys it is reasonable to assume that there would be, at most, transient summer usage of tree roosts by single or small numbers of common pipistrelle bat. There was no evidence within the data collected during the activity surveys to suggest that the trees within the woodland supported large numbers of roosting (or breeding) common pipistrelle bats, and no rare species of bats were recorded.

8.6.20 The habitats within the Site Boundary are therefore considered to be of Local value to roosting, foraging and commuting bats.

8.6.21 Further details on the scope, method and results of the bat surveys are provided in **Appendix 8.C [TR030008/APP/6.4]**.

Otter

8.6.22 The desk study returned one recent record of otter within the Desk Study Area (location withheld). Otter surveys of the West Site (Work No. 7) in 2011 and 2013 (excluding the newer ditches around the new road infrastructure, which had not been created at that time), which were the most recent surveys undertaken in West Site prior to the AECOM surveys in 2022/23, for a previous planning application (NELC reference DM/1027/13/OUT) did not record any evidence of this species.

8.6.23 It is possible that otters visit habitats within the Site Boundary as a place for rest or shelter given that they are likely present in the nearby Humber Estuary, but no sign of their presence or suitable breeding features were identified within terrestrial habitats closest to the estuary (e.g. Long Strip woodland). The large ditch at the base of the flood embankment (within Work No. 1) has the potential to provide foraging habitat for otter (particularly given its proximity and connectivity to the estuary) although no signs of otter were recorded during a survey undertaken in October 2022.

8.6.24 North Beck Drain, which runs along the eastern boundary of the temporary compound (Work No. 9) off Laporte Road, also provides suitable foraging and resting habitat for otter. This watercourse was not surveyed for otter as it is outside the Site Boundary and will not be directly impacted.

8.6.25 All the other ditches within the Site Boundary are considered unsuitable for otter. The ditches within the West Site (Work No. 7) (both the ditches associated with the original hedgerow boundaries, and those created in recent years as part of the consented development enabling works) are shallow and likely to be predominantly dry most of the time (due to being heavily overgrown with common reed) and therefore would not be expected to support sufficient fish to provide prey for foraging otter. The West Site is surrounded by roads and otters are

vulnerable to road traffic injury or fatality, therefore reducing the likelihood of otter being present. No evidence of otter was recorded on these ditches during an otter survey undertaken in October 2022, and it is concluded that the species is likely absent from these parts of the Site Boundary.

8.6.26 Despite the lack of otter field signs recorded during an otter survey of ditches within the Site Boundary undertaken in October 2022, given the recorded presence of otter in the Desk Study Area, it is reasonable to conclude that this species will likely use suitable habitats within and adjacent to the Site Boundary for foraging and passage on an occasional basis. The areas of occasional usage are likely to include North Beck Drain (adjacent to Work No. 9) and the large ditch at the base of the flood embankment (Work No. 1), as well as the estuary frontage/ intertidal mudflats (Work No. 1). This is a wide-ranging species that is likely to be found in suitable habitats throughout the Humber catchment, and it is therefore evaluated that these habitats within the Site Boundary are of Local value to populations of otter.

8.6.27 Further details on the scope, method and results of the otter survey are provided in **Appendix 8.D [TR030008/APP/6.4]**.

Water Vole

8.6.28 The desk study returned two recent records of water vole within the Desk Study Area, the closest of which was associated with a ditch on the north side of Kings Road approximately 55m north of the Site Boundary (West Site, Work No. 7).

8.6.29 Water vole surveys of the ditches on the West Site (Work No. 7) in 2011 and 2013 (excluding the newer ditches around the new road infrastructure, which had not been created at that time), conducted for a previous planning application (North East Lincolnshire Council planning reference DM/1027/13/OUT) did not record any evidence of this species. Those were the most recent surveys undertaken on West Site (Work No. 7) prior to the AECOM surveys in 2022/ 23.

8.6.30 The LWS citation for Laporte Road Brownfield Site LWS, which is approximately 150 m south of the Temporary Compound Area (Work No. 9) refers to a "*thriving population*" of water vole in North Beck Drain[3].

8.6.31 North Beck Drain, which runs along the eastern boundary of the Temporary Compound Area (Work No. 9) off Laporte Road, provides suitable potential habitat for water vole, and it is noted from the desk study that the species has previously been reported from this drain. This drain was not accessible for the water vole survey undertaken in October 2022; however, it will not be directly impacted by the Project.

[3] The LWS was originally surveyed by the local nature partnership in August 2008, and was most recently surveyed in May 2015 – it is not stated in the LWS citation on which survey the water vole population was identified.

8.6.32 The large ditch at the base of the flood embankment (Work No. 1) has the potential to provide habitat for water vole and has habitat connectivity via the drainage network to North Beck Drain, which has previously been recorded to support water vole. Surveys undertaken in 2022 recorded water vole field signs on the large ditch at the base of the flood embankment and the species is confirmed to be present. Given that there are desk study records of water vole on North Beck Drain, and the watercourse is connected to the ditch referred to above, it is reasonable to conclude that it also supports this species.

8.6.33 All the other ditches within the Site Boundary are considered unsuitable for water vole. The ditches within the West Site (Work No. 7) (both the ditches associated with the original hedgerow boundaries, and those created in recent years as part of the consented development enabling works) are shallow and likely to be predominantly dry most of the time (due to being heavily overgrown with common reed) and therefore would not be expected to support water vole. The ditches were surveyed for water vole in May 2022 and no evidence of water vole was found. These ditches were re-surveyed for water vole in October 2022 and no evidence of the species was found. It is therefore concluded that the species is likely absent from these ditches and they are not considered further in respect of this species.

8.6.34 Water vole is listed on the Local BAP (Ref 8-13) as 'widespread' within the county, which is noted to be a population stronghold within the UK despite the national trend for a significant decline in this species. It is therefore evaluated that the water vole population identified within the Study Area is of County nature conservation value. Although the ditch within the Site Boundary is of relatively low quality, it provides additional habitat to support this population.

8.6.35 Further details on the scope, method and results of the water vole survey are provided in **Appendix 8.D [TR030008/APP/6.4]**.

Great Crested Newt

8.6.36 The desk study returned no recent records of great crested newt within the Desk Study Area. Surveys of the wetland complex in the landfill site (Pond 3) adjacent to West Site (Work No. 9) conducted in 2011 and 2013 for a planning application (NELC planning reference DM/1027/13/OUT) did not record great crested newt.

8.6.37 There are no ponds within the Site Boundary. Four ponds have been identified within 250m of the Site Boundary, and these are considered in further detail below:

a. Pond 1 (TA 211 155) – approximately 10m from Site Boundary – this is a large fire water storage lagoon within the Associated Petroleum Terminal site, which lies to the immediate west of the jetty landfall site (Work No. 1 and Work No. 2). The pond is partially shaded by woodland along the southern bank and supports stands of common reed to its margins.

b. Pond 2 (TA 210 154) – approximately 95m from the Site Boundary – aerial photography indicates this is a square lagoon within the Associated Petroleum Terminal site; however, this structure is an emergency storage bund providing capacity for spillages from the Associated Petroleum Terminal

site. This 'pond' is therefore discounted as a potentially suitable habitat for great crested newt as it does not regularly hold water such that it could support breeding amphibians, and was therefore scoped out of the eDNA surveys.

c. Pond 3 (TA 198 141) – approximately 100m from Site Boundary – this is a complex of ponds used for drainage within the landfill site that lies to the south of West Site (Work No. 9). It is assumed that the waterbodies are relatively transient due to the nature of the site, resulting in change/ disturbance to their location and extent. The ponds were not accessible for survey. As great crested newt was not recorded in previous surveys, and there are major barriers[4] to great crested newt dispersal onto the landfill site, there is no reasonable likelihood of great crested newt being present at this location.

d. Pond 4 – approximately 10m from Site Boundary – this is a process lagoon within the Associated Petroleum Terminal site that is regularly drained and therefore is not suitable for breeding amphibians, and was scoped out of the eDNA surveys.

8.6.38 An eDNA survey of Pond 1 was undertaken in June 2023 and returned a negative result for great crested newt. It is therefore reasonable to conclude that this species is likely absent from the waterbody, and will not be present in terrestrial habitats within 250m of the waterbody. No further consideration is therefore given to this species within this assessment.

8.6.39 The large drainage ditch at the base of the flood embankment (within Work No. 1) was considered to represent potentially suitable habitat for great crested newt, although saline influences could not be ruled out given its proximity to the estuary and its potential interactions with the marine environment. The ditch was subject to eDNA sampling in June 2022, which returned an 'inconclusive' result, which is often a result of chemical contamination of a watercourse. It is concluded that this habitat is likely unsuitable for great crested newt given its likely contamination and saline influence, and therefore it is not considered further in the assessment. This conclusion is further strengthened by the negative eDNA result from Pond 1, which is very close (within 10m) to the ditch. If great crested newts had been present in Pond 1 then it would have been more likely that they could also be present in the ditch.

[4] The following constitute major barriers to dispersal and are unlikely to be traversed by great crested newts: rivers and larger streams; main roads such as A-roads, motorways or any other road with high traffic volume (i.e. high traffic volume during the night when great crested newt are more likely to be dispersing/ commuting); and major urban infrastructure including extensive areas of hardstanding and buildings and dense networks of minor roads with little green space.

8.6.40 The other drainage ditches within the Site Boundary are subject to seasonal fluctuations in water levels and have been observed during the course of other surveys to regularly dry out in the Spring/early Summer. They are therefore unsuitable for breeding great crested newt because they do not regularly hold sufficient water or aquatic vegetation to enable successful breeding activity (the larvae of this species are entirely aquatic until late Summer).

8.6.41 Further details on the scope, method and results of the great crested newt survey are provided in **Appendix 8.E [TR030008/APP/6.4]**.

Terrestrial Invertebrates

8.6.42 The desk study returned ten recent records of notable species including the white-letter hairstreak butterfly (*Satyrium w-album*), which is a UK Priority Species. Elms (*Ulmus* spp.), the larval foodplant of white-letter hairstreak, are scattered throughout the Long Strip woodland (see **Appendix 8.F [TR030008/APP/6.4]**), and this butterfly species is noted to be present within the Long Strip Woodland north of Laporte Road (Work No. 2).

8.6.43 A walkover survey of the habitats within the Site Boundary was undertaken by a terrestrial invertebrate specialist in July 2022 and it was concluded that the habitats were unsuitable to support any significant populations of rare and/or notable terrestrial invertebrate species. It was concluded that the habitats within the Site Boundary are of Site value only to terrestrial invertebrate species, and further detailed invertebrate surveys of the habitats were not warranted. No further consideration is therefore given to terrestrial invertebrates in this assessment.

8.6.44 Further details on the scope, method and results of the terrestrial invertebrate habitat appraisal are provided in **Appendix 8.B [TR030008/APP/6.4]**.

Protected Species Summary

8.6.45 A summary of the protected species surveys undertaken to inform the EcIA and the results obtained are presented in **Table 8-5**.

Table 8-5: Protected Species Summary and Evaluation

Species	Desk Study Records	Field Survey Result	Evaluation of Nature Conservation Value	Scoped into Assessment?
Badger	No records from study area.	• No evidence of badger presence. • May be present on transient and occasional basis.	Site	No
Bats	No records from study area.	• Majority of habitats are of low quality for foraging/ commuting bats due to the open nature of the land and the	Local	Yes

Species	Desk Study Records	Field Survey Result	Evaluation of Nature Conservation Value	Scoped into Assessment?
		lack of botanical species diversity to provide large numbers of insect prey. • Long Strip woodland (Work No. 2) is of slightly higher value to foraging/ commuting bats as it provides a sheltered habitat corridor and might also be utilised by roosting bats. • In woodland to be cleared for (Work No. 2);one confirmed bat tree roost (T32) within Long Strip woodland, two trees with high bat roost potential and 16 with moderate bat roost potential, which may support single/low numbers of roosting common pipistrelle (transient summer roosts).		
Otter	One record in study area (location withheld). Likely to be present in Humber Estuary.	• No evidence of this species recorded during survey. • Otter assumed likely present occasionally foraging/on passage on North Beck Drain (outside site boundary adjacent to Work No. 9) and ditch at base of flood embankment (Work No. 1), as well as along estuary frontage (Work No. 1). • All other ditches unsuitable for otter, and no evidence of the species was recorded during surveys.	Local	Yes
Water vole	One record from Kings Road area approximately 55m from the Site Boundary.	• Water vole presence confirmed in ditch at base of flood embankment (Work No. 1), and also likely to be present in North Beck Drain (outside site boundary). • All other ditches unsuitable for water vole, and no evidence of the species was recorded during surveys.	County	Yes
Great Crested Newt	No records within study area.	• No ponds within Site Boundary. • Pond 1 (within Associated Petroleum Terminal site adjacent to Work No. 2) returned negative eDNA sample. • Ponds 2 and 4 (within Associated Petroleum Terminal site adjacent to Work No. 2) unsuitable for GCN.	Not applicable	Not applicable

Species	Desk Study Records	Field Survey Result	Evaluation of Nature Conservation Value	Scoped into Assessment?
		• Pond 3 (wetland complex in landfill site south of Work No. 7) was not accessible for survey but was surveyed in 2011 and 2013 and great crested newt was not recorded. • Most ditches within Site Boundary are regularly dry in late Spring and are therefore unsuitable for breeding great crested newt. • Species considered likely absent based on negative eDNA survey results and lack of desk study records.		
Terrestrial invertebrates	Ten recent records of notable species including white-letter hairstreak.	• Habitats considered to be of low importance for terrestrial invertebrates. White-letter hairstreak butterfly records in Long Strip Wood; this species, along with other terrestrial invertebrate species recorded in the woodland, has been assessed with respect to the loss of woodland habitat supporting a terrestrial invertebrate assemblage.	Site	No

Invasive Non-native Plants

8.6.46 No non-native invasive plant species were recorded within the Site Boundary during site surveys undertaken in 2022 and 2023.

Future Baseline

8.6.47 As set out in **Chapter 5: EIA Process**, the following future baseline scenarios have been considered; short term (2025); medium term (2042) and long term (2060).

8.6.48 In the short term, in the absence of the Project, and assuming a continuation of port operations associated with the East Site – Ammonia Storage (Work No. 3), and continued absence of development of West Site (Work No. 7), it is concluded that the limited suite of semi-natural habitats recorded would not change significantly. It is therefore reasonable to conclude that there would continue to be negligible potential for protected species to occur within that part of the Project footprint.

8.6.49 In the medium to long term, in the absence of the Project and other development, the habitats within the West Site (where Work No. 7 is proposed) and East Site – Ammonia Storage (Work No. 3) would be expected to become further overgrown and encroached by the invading willow scrub, reducing the prevalence of grassland habitat. These habitats may provide additional nesting opportunities for breeding birds, and in the longer term, roosting opportunities for bats.

8.6.50 Similarly, in the absence of the Project within the East Site – Ammonia Storage (where Work No. 3 is proposed), pioneer vegetation communities on the bare substrate areas would become further established and could increase its ecological value in terms of the niches and habitats provided for plant species and invertebrates. Over an approximate five to 15 year timeframe, it is reasonable to assume that a mosaic of habitats may become sufficiently well established to meet all the criteria for open mosaic habitat ("OMH") UK Priority Habitat or have otherwise been replaced by other habitat types e.g. loss to scrub invasion. Similarly, areas of scrub and trees would mature further and may provide additional nesting opportunities for breeding birds and roosting opportunities for bats in the absence of any development.

8.6.51 The woodland within Long Strip (where Work No. 2 is proposed) is not expected to change significantly over the short or medium term in the absence of the Project, as it is not subject to any substantial management/ commercial timber extraction. Biodiversity enhancement works have taken place previously and maintenance is undertaken as required to maintain clear access to the bridleway. Given the presence of mature ash, the woodland is at potential risk of losing specimens to ash dieback disease, which is spreading in the UK. This may result in the loss of some specimens and an opening up of the canopy layer in the short to medium term scenario, which would increase the abundance of the ground flora and may encourage the development of more diverse ground flora species, at least until the canopy closes again. The presence of additional deadwood may also attract a greater diversity of terrestrial invertebrates and fungi to increase the biodiversity of the woodland.

8.6.52 The continuation of agricultural cultivation of the arable field in the Temporary Construction Area (where Work No. 9 is proposed) is not anticipated to result in any changes to the ecological baseline of the habitats in the short, medium or long-term scenarios.

8.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

8.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to terrestrial ecology through the process of design development, and by embedding mitigation measures into the design.

8.7.2 Impacts on woodland within Long Strip have been minimised as far as possible in the design of the jetty access road, pipe-rack and associated buildings and plant which comprise Work No. 2. However, the permanent loss of woodland within the Long Strip requires that compensatory measures be agreed with the local planning authority. Policy 41 (1D) of the North East Lincolnshire Local Plan 2018

states that the council will seek to specifically "*minimise the loss of biodiversity features, or where loss is unavoidable and justified ensure appropriate mitigation and compensation measures are provided*". The commitment to a compensation strategy for woodland loss is secured by a DCO Requirement and an **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** has been prepared.

8.7.3 Opportunities for landscape planting within the terrestrial parts of the operational site are limited. This is a function of both the security and operational requirements of a hydrogen production facility, as well as the limited space available within the footprint of the works. However, the **Outline LEMP [TR030008/APP/6.9]** defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. The measures which are proposed include:

a. Wildflower grassland creation in peripheral areas of the site to provide ecological niches for terrestrial invertebrates and feeding habitat for birds,

b. Planting of native trees, shrubs and hedgerows in peripheral areas of the site to create nesting habitat for birds (once matured) and to provide sources of berries for overwintering birds,

c. Installation of bird and bat boxes.

8.7.4 Surface water discharge from the operational Site would be attenuated to green-field run-off rates as set out in the **Drainage Strategy** appended at **Appendix 18.B [TR030008/APP/6.4]** and therefore there would be unlikely to be any changes in the flow rates within the adjacent drainage ditches.

8.7.5 The operational Project design aims to minimise lighting impacts beyond the Site Boundary, for example by minimising light overspill and directing lighting away from adjacent habitats, as set out in the **Lighting Assessment Report** appended at **Appendix 2.B [TR030008/APP/6.4]**.

8.7.6 Mitigation for protected species to ensure legislative compliance would be in place and is covered in the assessment sections below as relevant. Protected species mitigation would be secured through the appropriate licensing requirements as summarised below:

a. Water vole – given that the length of bank from which water vole would be displaced for the Project (within Work No. 1) is less than 50 m, mitigation through a Water Vole Class Licence approach will be adopted for the construction phase; this requires sensitive timing of vegetation clearance to achieve natural displacement of water voles through habitat manipulation under the supervision of an ecologist holding a Water Vole Class Licence from Natural England.

b. Bats – any trees to be removed that support confirmed bat roosts, following completion of emergence surveys in summer 2023, will be removed under the supervision of an ecologist holding a Bat Low Impact Class Licence from Natural England. This is on the basis that the woodland is likely to only support, at most, up to three 'low conservation status' roosts (i.e. feeding, day, night and transitional roosts) based on the very low numbers of bats recorded during walked transects undertaken over spring, summer and

autumn 2022, and therefore tree removal would fall within the remit of a Low Impact Class Licence. In the event that a higher number of confirmed roost trees, and/ or the roosts are not considered to be low conservation status, then a European Protected Species Mitigation ("EPSM") derogation licence would be obtained from Natural England. Where mature trees within the Long Strip woodland with low bat roost potential would be impacted and cannot reasonably be avoided, trees will be soft-felled under ECoW supervision.

Standard Mitigation Measures

8.7.7 Construction of the Project would be subject to measures and procedures defined within a Construction Environmental Management Plan ("CEMP"), which would be produced prior to the commencement of construction by the Principal Contractor and would be based on, and incorporate, the contents and requirements of the **Outline CEMP [TR030008/APP/6.5]**.

8.7.8 The CEMP would include measures for prevention of surface and ground water pollution, fugitive dust management and noise prevention or amelioration. Measures to be included in the CEMP will include the following:

a. An Environmental or ECoW will be present during construction as appropriate to oversee implementation of impact avoidance commitments.

b. Precautionary working methods would be adopted to manage any residual risk of protected species being encountered e.g. reptiles and badger, and a Precautionary Working Method Statement ("PWMS") will be prepared as part of the CEMP. These measures would include staged removal of potentially suitable vegetation under the supervision of an ecologist, and the covering of excavations overnight to prevent animals becoming trapped.

c. Precautionary measures will be implemented to prevent trapping wildlife in construction excavations, in order to ensure compliance with animal welfare legislation. Any excavations would be covered overnight, or where this is not practicable, a means of escape would be fitted (e.g. battered soil slope or scaffold plank situated at or below a 45 degree angle), to allow animals (e.g. otter, badger, hedgehog, amphibians) to vacate excavations should they fall in. Where excavations had to be left uncovered overnight they would be checked for presence of animals prior to infilling.

d. Construction temporary lighting will be arranged so that glare would be minimised outside the construction site. Measures to minimise the impact of construction lighting would be detailed in the Final CEMP.

8.8 Assessment of Likely Impacts and Effects

8.8.1 The assessment identifies that construction, operation and decommissioning of the Project has the potential to result in adverse effects on terrestrial ecology.

8.8.2 This section describes the impacts and effects during the construction, operation and decommissioning of the Project on the relevant ecological features. It should be noted that the impact is described under the first stage of the Project which is relevant even if the impact is maintained for later phases (e.g. habitat loss).

8.8.3 To enable focussed impact assessment, only impact pathways that have the potential to result in significant effects on ecological features have been screened into the impact assessment. Those impacts that are considered unlikely to result in significant effects are scoped out and are not considered further.

8.8.4 The assessment considers development design and mandatory and embedded mitigation measures as set out in **Section 8.7.**

Construction

8.8.5 This section provides an assessment of the potential construction impact pathways on nature conservation (terrestrial ecology) which might arise during the construction phase of the project. The following pathways have been scoped into the impact assessment:

a. Loss of woodland habitat within Long Strip (Borough nature conservation value).

b. Loss of bat roosts (Site nature conservation value).

c. Noise/visual disturbance to otter (Local nature conservation value).

d. Damage/loss of habitat supporting water vole and noise/visual disturbance (County nature conservation value).

Loss of Woodland Habitat

8.8.6 Construction of Work No. 2 which constitutes the pipe-rack line from the jetty and the new jetty access road would result in direct impacts on Long Strip woodland (the section on the north side of Laporte Road), a mature semi-natural woodland of Borough nature conservation value. The construction footprint and permanent land take has been minimised as far as practicable in the design of the jetty access road, pipe-rack and related plant and buildings (refer to the description of the Project in **Chapter 2: The Project [TR030008/APP/6.2]** and **Chapter 3: Needs and Alternatives [TR030008/APP/6.2]**. However, permanent loss of woodland results in a conflict with Local Planning Policy 41, which states that the council will seek to minimise the loss of biodiversity features, in the absence of appropriate mitigation/compensation.

8.8.7 Approximately 0.64ha of woodland would be removed within the northern section of the Long Strip woodland, associated with the construction of Work No. 1 and Work No. 2. This is approximately 40% of the area of woodland within that part of the Long Strip TPO boundary north of Laporte Road. This tree loss would have a large impact on the woodland and its role in the local network of green infrastructure, although the veteran ash tree and a strip of woodland would be retained along the eastern boundary of Work No.2 (and the terrestrial part of Work No. 1), meaning that woodland habitat connectivity to the ditch/ flood embankment to the north would be retained in part, rather than resulting in severance from this feature. Mature deciduous woodland is already reduced in

extent and fragmented in the county due to the predominance of agricultural cultivation. Further, in this part of North East Lincolnshire there is very little woodland present due to the presence of the operational port of Immingham and the surrounding industrial land use.

8.8.8 Reduction in the woodland size could expose it to increased impacts from adjacent land-use e.g. agricultural inputs (both biocides and/ or nutrient enrichment) from neighbouring fields, which could affect a greater proportion of the remaining woodland, leading to changes in woodland composition and structure. This would also affect the distribution and number of breeding birds and terrestrial invertebrate species within the woodland, as their respective ecological niches would be reduced and/or changed due to the edge effect resulting from the woodland loss.

8.8.9 The permanent loss of woodland of this age and structure can only be compensated over the medium to long term. Compensatory woodland planting, secured under the **Outline Woodland Compensation Strategy [TR030008/APP/6.8]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated as described in **Section 8.7**. This permanent loss of woodland would compromise the structure and function and/ or conservation status of Long Strip woodland, including the species it supports (which include nesting birds and terrestrial invertebrates such as white-letter hairstreak butterfly). Therefore, the effect is assessed as meaningful at the Borough level and is therefore defined as **moderate adverse** and **significant**.

Loss of Bat Roosts

8.8.10 At least one tree supporting a bat roost (likely to be common pipistrelle) would be lost to development associated with the woodland loss described above. I*t* is assumed that some of the trees present could be suitable for use by roosting bats. However, the very limited bat activity recorded during the bat foraging surveys indicates that even if roosts are present, they are only likely to be used by small numbers of common bat species i.e. relatively low value roost types (Site value) that could be readily compensated through standard good practice embedded mitigation. In the absence of mitigation, it is assessed that the loss of trees supporting a small number of common species of roosting bats of Site value would be **minor adverse** and **not significant**.

Damage/Loss of Habitat Supporting Otter, and Related Construction Noise/ Visual Disturbance

8.8.11 Otter is likely to be present occasionally on North Beck Drain and the ditch at the base of the flood embankment and may be affected by noise and visual disturbance arising from Project construction. If this disturbance affects locations used as resting places, then this would result in potential conflicts with legal protection afforded to this species under The Conservation of Habitats and Species Regulations 2017 (as amended). However, otter is a wide-ranging species that is likely to be found in suitable habitats throughout the Humber catchment. Therefore, it is not likely to be specifically dependent, for resting or

foraging, on the North Beck Drain and/or the ditch i.e. these habitats are of up to Local value. Even if part of an otter territory is present within or adjacent to the Site, there is likely to remain sufficient unaffected habitat for otter within its wider territory for foraging and breeding to be unaffected. Applying the precautionary principle however, the effect of noise/visual disturbance is assessed as meaningful at the Local level and is therefore assessed as **minor adverse** and **not significant**).

8.8.12 Standard mitigation during construction to protect watercourses that may support otter, and will ensure there is no pollution to the watercourses, and these measures are incorporated in the CEMP, as well as embedded mitigation to reduce run-off to green field rates. No adverse effects on watercourses that may support foraging/transient otter are therefore predicted during construction, and this pathway is assessed as resulting in a **negligible** effect (**not significant**) effect on otter.

Damage/Loss of Habitat Supporting Water Vole, and Related Construction Disturbance

8.8.13 This species is present on the ditch at the base of the flood embankment and riparian habitats supporting this species may be directly impacted by Project construction activities for Work No. 2 (the pipe-rack and jetty access road), which require a crossing of this ditch.

8.8.14 However, direct habitat impacts would be minor in extent and would not affect large retained areas of habitat. There could also be indirect impacts on habitats e.g. construction works may temporarily reduce the water supply to ditches leading to the drying out of ditch habitat earlier in the year than usual. Noise and visual disturbance could also disturb water voles. However, these impacts are only likely to displace a small number of individual water voles within the impacted section of the ditch, and not the entire population at the Site.

8.8.15 North Beck Drain is also likely to support water vole given the habitat connectivity to the ditch at the base of the flood embankment. However, other than the crossing of the adjacent channel with a small scaffold bridge to enable the diversion for Bridleway 36 (see **Chapter 2: The Project [TR030008/APP/6.2]**), this watercourse will not be affected by construction activities within the temporary construction compound (Work No. 9) off Laporte Road, which would border the watercourse. Standard mitigation during construction to protect watercourses will ensure there is no pollution to the watercourses, and these measures are incorporated in the CEMP. As a result of the existing flood embankment at this location, which would be retained throughout, a buffer zone would be demarked between the watercourse and the proposed construction compound (Work No. 9). It is not considered that there is any potential for indirect effects on water vole e.g. due to noise and visual impacts during construction.

8.8.16 The water voles present at the Site are likely to be part of a more widely distributed population within the Study Area and the conservation status of the population is not likely to be affected. Applying the precautionary principle, however, the effect is assessed as meaningful at the County level and is assessed as **minor adverse** and **not significant**).

Impact Pathways Scoped Out

8.8.17 The following impact pathways during Project construction have been scoped out of this assessment:

a. Loss of habitats other than woodland – all other habitats within the Site Boundary are of Site nature conservation value only and are not relevant ecological features for the purposes of ecological impact assessment.

b. Lighting disturbance/ disruption to foraging bats – the impacted habitats are used by very low numbers of foraging bats, which are evaluated to be of Site nature conservation value only and are therefore not relevant ecological features for the purposes of ecological impact assessment.

c. Dust emissions – standard measures to control fugitive dust emissions have been incorporated into the CEMP (see **Chapter 6: Air Quality [TR030008/APP/6.2]** for further details) for legislative compliance and therefore there would be no potential for dust smothering to adjacent higher value habitats within Laporte Road Brownfield Site LWS.

d. Road traffic emissions – the predicted number of construction vehicle movements on Queens Road, Immingham and Cleethorpes Road, Grimsby exceeds Institute of Air Quality Management ("IAQM") and Environmental Protection UK ("EPUK") screening guidance and therefore this pathway has been scoped into the air quality impact assessment (see **Chapter 6: Air Quality [TR030008/APP/6.2]**). However, there are no designated sites for terrestrial ecology within 200 m of the Affected Road Network ("ARN"). On all other local roads, the predicted number of construction vehicle movements does not exceed the IAQM threshold below which a road traffic impact is unlikely to contribute to a significant effect on local air quality. No related impacts on ecological receptors are therefore predicted.

e. Surface water pollution – standard measures to control surface water run-off during construction have been incorporated into the CEMP for legislative compliance and therefore there would be no potential for pollution to impact adjacent higher value habitats such as North Beck Drain and Laporte Road Brownfield Site LWS, or any watercourses supporting otter and/ or water vole.

Operation

8.8.18 The following section provides the assessment of the potential operational impact pathways on nature conservation (terrestrial ecology) arising during operational phase of the project. As noted above, those impacts related to habitat loss, which arise during the construction phase, would also be relevant to this phase. The following impact pathways have been scoped into the impact assessment for the operational phase:

a. Lighting disturbance to foraging bats (Site nature conservation value).

b. Noise/visual disturbance to otter (Local nature conservation value).

c. Noise/visual disturbance to water vole (County nature conservation value).

8.8.19 These three impact pathways are considered in greater detail below.

Lighting Impacts on Foraging Bats

8.8.20 Operation of the Project requires new external lighting at the East Site (Works No. 3 and No. 5) and West Site (Work No. 7). Operational lighting can be detrimental for bats if poorly designed and located in proximity to habitats of importance for bats e.g. important foraging habitats or movement corridors providing access to important foraging habitats. Light spill and glare can deter bats from accessing affected preferred habitats, and by so doing force bats to use habitats that are less suitable for foraging or expend more energy to go around the lit areas to access foraging habitats.

8.8.21 Given the existing very low levels of bat activity, the habitats present are considered to be of Site value only for bats. The **Lighting Assessment Report** appended at **Appendix 2.B [TR030008/APP/6.4]** includes a commitment to include sensitive design of external artificial lighting to minimise light spill to retained habitats. This is secured by way of a DCO Requirement. Accordingly, there is no reasonable likelihood of an impact on the conservation status of bats as a result of operational lighting.

8.8.22 Applying the precautionary principle and taking into account the embedded mitigation in the Lighting Strategy for sensitive lighting design, the effect is assessed as meaningful at the Site level and is therefore assessed as **minor adverse** and **not significant**.

Noise/Visual Disturbance to Otter

8.8.23 Routine operational activities are not likely to disturb Otters. Otters are regularly encountered in association with urban watercourses and areas of industrial activity, indicating that once the peak disturbance arising from construction is completed, any otters present are likely to habituate to operational regimes. It is therefore assessed that operational noise and visual disturbance will result in a **negligible** effect on otter which is **not significant**.

Noise/Visual Disturbance to Water Vole

8.8.24 The rationale for otter is equally applicable to water vole. This species is likely to occur if suitable habitats are present regardless of operational activities on adjacent land. Even if there is operational disturbance in the vicinity of the jetty (Work No. 1) and the pipe-rack/jetty access road (Work No. 2) at levels that could disturb water voles, this has the potential to result in only very localised disturbance/ displacement of water voles from the eastern end of the ditch at the base of the flood embankment. This would only impact a very small numbers of voles, and it is reasonable to assume that there is sufficient habitat adjacent to the east (on the same ditch) and further east associated with North Beck Drain, to accommodate any individual water voles displaced from the short section within the vicinity of the operational area. It is therefore assessed that operational noise and visual disturbance will result in a **minor adverse** effect on water vole which is **not significant**.

Impact pathways Scoped Out

8.8.25 The following impact pathways during the operational phase of the project have been scoped out of the assessment:

a. Road traffic emissions – the predicted number of operational vehicle movements is lower than the IAQM and EPUK screening guidance (see **Chapter 6: Air Quality [TR030008/APP/6.2]**), below which a road traffic impact is unlikely to contribute to a significant effect on local air quality.

b. Surface water pollution – standard measures to control surface water run-off during operation are embedded within the Project design for legislative compliance, and therefore there would be no potential for pollution to impact adjacent higher value habitats such as North Beck Drain and Laporte Road Brownfield Site LWS.

Decommissioning

8.8.26 The likely impacts arising from decommissioning of the terrestrial elements of the project would be of similar magnitude and scale to those described for the construction phase, with the exception that the woodland loss would already have occurred in the construction phase (and no further loss would be required).

8.8.27 The potential for adverse decommissioning impacts and effects on habitats and species would be limited by the nature of the proposed decommissioning activities. It is assumed that decommissioning would remove all above ground infrastructure and that buried pipelines etc would be made safe and left in situ. Therefore, there would be no requirement to remove or disturb habitats to remove buried infrastructure, and no species associated with these habitats would be affected.

8.8.28 On this basis, it is concluded that there would be no likely significant effects on terrestrial ecology receptors anticipated as a result of decommissioning.

8.9 Mitigation and Enhancement Measures

Loss of Woodland Habitat

8.9.1 In order to compensate for tree loss from the Long Strip associated with the construction of the jetty access road and the pipe-rack [Work No. 2 and Work No 1 (terrestrial elements only)], the following approach is proposed:

a. Enhancement of retained parts of the Long Strip TPO woodland north of Laporte Road; and

b. Off-site woodland creation and management in an approximate 2ha area of land within the Applicant's ownership off Manby Road (within the port area), which has been identified as being suitable for this purpose.

8.9.2 An **Outline Woodland Compensation Strategy** has been prepared **[TR030008/APP/6.8**] to outline these commitments. The Strategy sets out the approach to off-site planting of trees in the Immingham area, as well as enhancement of existing retained on-site woodland, to ensure that the tree loss from the Long Strip is appropriately compensated. The Strategy has been discussed with the local planning authority and is secured by DCO Requirement

to ensure compliance with Local Planning Policy 41, which states that the council will seek to *"..minimise the loss of biodiversity features, or where loss is unavoidable and justified ensure appropriate mitigation and compensation measures are provided*..".

8.9.3 Mitigation will be implemented during construction to ensure the protection of retained trees with appropriate root protection areas, and these will be clearly marked in the CEMP.

Loss of Bat Roosts

8.9.4 A licence would be needed from Natural England to ensure compliance with the Habitats Regulations to permit the loss of the known roost(s) in the Long Strip woodland. It is reasonable to assume that works could proceed under a Bat Low Impact Class Licence (which is held by a suitably experienced bat ecologist) for' low conservation value roosts' i.e. for removal of up to three roosts used by small numbers of common species of bats as transient day, night or feeding roosts. Standard mitigation would be employed during the construction phase as necessary to meet the terms of the bat licence e.g. tree removal in the winter months, during October to March (which would also be required as standard mitigation for breeding birds). In the event that ongoing surveys identify more than three confirmed tree roosts and/or that the roosts support species not considered common for the purposes of the Low Impact Class Licence (i.e. any species other than common pipistrelle, soprano pipistrelle, brown long-eared, whiskered, Brandt's, Daubenton's or Natterer's bats), a European Protected Species Mitigation ("EPSM") development licence will be obtained from Natural England.

Damage/Loss of Habitat Supporting Water Vole

8.9.5 A licence to damage/disturb water vole habitat would be required from Natural England for works to the drainage ditch at the base of the flood embankment (Ditch 5). Given the limited extent of the works (<50m of ditch bank affected), it is considered that the activities would fall within the remit of undertaking works under the supervision of an ecologist with a Natural England Class Licence. No fenced exclusions or translocations of water voles are proposed.

8.9.6 The mitigation approach would require appropriate seasonal timing of habitat clearance works to displace water voles prior to damage/destruction of habitats within Ditch 5, and as such initial vegetation clearance works would be limited to the period 15 February to 15 April and/or 15 September to 31 October. Subsequent works to maintain the cleared area can be undertaken after this initial seasonally restricted clearance period to ensure the habitats remain unsuitable for water vole prior to the commencement of construction. Construction works to the ditch would not be seasonally constrained following the completion of the initial vegetation clearance works under the Class Licence, assuming the banks are maintained as unsuitable for water vole in the period between the initial clearance and the commencement of construction activities at this location.

8.9.7 A water vole method statement would be prepared, in due course, by the Contractor, as part of the Final CEMP.

8.10 Assessment of Residual Effects

Construction

Loss of Woodland Habitat

8.10.1 The permanent loss of woodland of this age and structure can only be compensated over the medium to long term. Compensatory woodland planting will be secured under the **Outline Woodland Compensation Strategy [TR030008/APP/6.8**] described in **Section 8.7**. However, for the purposes of this assessment, even with compensation in place, give the time taken for the compensatory habitat to mature, the loss of woodland habitat is considered to be permanent and irreversible. It is therefore assessed that the residual effect remains moderate adverse (**significant**).

Loss of Bat Roosts

8.10.2 The requirement for a Natural England licence would provide a legally enforceable mechanism to ensure that there is no significant adverse effect on bat populations. The required mitigation under this licence would involve routine measures that can be expected to be successful.

8.10.3 On this basis, given legal requirements would need to be and can be met, the potential residual effect on roosting bats is precautionarily assessed as remaining as minor adverse (**not significant**). This is on the basis that any required mitigation would ensure compliance with UK Wildlife Legislation but would not reduce the magnitude or severity of the impact on individual roosting bats.

Noise/Visual Disturbance to Otter

8.10.4 No mitigation requirements have been identified. The residual effect on otter is therefore assessed as meaningful at the Local level and as minor adverse (**not significant**).

Damage/Loss of Habitat Supporting Water Vole

8.10.5 The requirement for a Natural England licence would provide a legally enforceable mechanism to ensure that there is no significant adverse effect on water vole populations. The required mitigation under this licence would involve routine measures that can be expected to be successful.

8.10.6 On this basis, given legal requirements would need to be and can be met, the potential residual effect on the conservation status of water voles is precautionarily assessed as remaining as minor adverse (**not significant**). This is on the basis that any required mitigation would ensure compliance with UK Wildlife Legislation but would not reduce the magnitude or severity of the impact on individual water voles.

Operation and Decommissioning

8.10.7 No significant residual operational or decommissioning effects on terrestrial ecology receptors are predicted.

8.11 Summary of Assessment

8.11.1 **Table 8-6** provides a summary of the likely significant terrestrial ecology effects associated with the Project.

8.11.2 This ecological impact assessment identifies limited potential for significant adverse effects on terrestrial ecology features. This is because the Project generally coincides with land of low biodiversity value, and consequently there is (a) little potential for protected and notable species to occur, and (b) surveys have concluded the minimal presence or likely absence of such species.

8.11.3 One significant (moderate adverse) terrestrial ecology effect is predicted. This relates to the permanent loss of UK Priority deciduous woodland habitat during Project construction as a result of the routing of the pipeline and jetty access road (Work No. 2) through the Long Strip woodland. This impact would result in a conflict with planning policy, as well as being adverse for nature conservation at the Borough level. The loss of parts of this mature woodland would be compensated by the delivery of the **Outline Woodland Compensation Strategy [TR030008/APP/6.8**]. However, compensation for the loss of mature woodland would not be achieved over the operational life of the terrestrial elements of the Project and the residual effect would remain significant over the long term.

8.11.4 No other likely significant ecological effects on designated nature conservation sites, habitats or species are predicted during Project construction, operation or decommissioning.

Table 8-6: Summary of Assessment –Likely Significant Effects

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Construction Phase					
Mature deciduous woodland	Pipe-rack and jetty access road construction resulting in loss of/damage to woodland habitat	Moderate adverse (Significant)	Design of pipe rack and jetty access road has minimized the woodland loss as far as possible. A **Woodland Compensation Strategy [TR030008/APP/6.8]** is secured by a DCO Requirement but does not mitigate effect of permanent woodland loss.	Moderate adverse (Significant)	High
Bat roosts	Loss of minor tree roosts during Pipe-rack and jetty access road construction	Minor adverse (Not significant)	EPSM licence or Low Impact Class Licence	Minor adverse (Not significant)	High
Otter (foraging)	Noise and visual disturbance	Minor adverse (Not significant)	Buffer zone from edge of North Beck Drain secured under the Water Vole. Natural England Class Licence. Sensitive temporary lighting design to minimise spill (CEMP).	Minor adverse (Not significant)	High
	Habitat damage/loss to habitats that may support foraging/ transient otter	Negligible (Not significant)	**Drainage Strategy** appended at **Appendix 18.B [TR030008/APP/6.4]**	Negligible (Not significant)	High

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
			includes embedded mitigation to reduce run-off to green field rates.		
Water vole	Habitat damage/loss to ditch supporting water voles that will be culverted for the jetty access road.	Minor adverse (Not significant)	Displacement of water voles from affected habitats under Natural England Class Licence. **Drainage Strategy** appended at **Appendix 18.B [TR030008/APP/6.4]** includes embedded mitigation to reduce run-off to green field rates.	Minor adverse (Not significant)	High
	Noise and visual disturbance	Minor adverse (Not significant)	Buffer zone from edges of North Beck Drain secured under the Natural England Class Licence. Sensitive temporary lighting design to minimise spill (CEMP).	Minor adverse (Not significant)	High
Operational Phase					
Bats (foraging)	Lighting disturbance	Minor adverse (Not significant)	The Lighting Strategy includes sensitive permanent lighting design to minimize spill to adjacent habitats	Minor adverse (Not significant)	High

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Otter (foraging)	Noise and visual disturbance	Negligible (Not significant)	Buffer zone from edge of North Beck Drain. The Lighting Strategy includes sensitive permanent lighting design to minimize spill to adjacent habitats	Negligible (Not significant)	High
Water vole	Noise and visual disturbance	Minor adverse (Not significant)	Buffer zone from edge of North Beck Drain. The Lighting Strategy includes sensitive permanent lighting design to minimize spill to adjacent habitats	Minor adverse (Not significant)	High
Decommissioning Phase					
Otter (foraging)	Noise and visual disturbance	Minor adverse (Not significant)	Buffer zone from edges of watercourses. Sensitive temporary lighting design to minimise spill (Decomissioning Environmental Management Plan ("DEMP")).	Minor adverse (Not significant)	High
	Habitat damage/loss to habitats that may support foraging/ transient otter	Negligible (Not significant)	Protective measures to maintain water quality and levels (DEMP).	Negligible (Not significant)	High

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Water vole	Habitat damage/loss	Minor adverse (Not significant)	Displacement of water voles (if confirmed present following updated survey work prior to decommissioning) from affected habitats under Natural England Class Licence (where necessary based on licensing requirements at the time of decommissioning).	Minor adverse (Not significant)	High
	Noise and visual disturbance	Minor adverse (Not significant)	Buffer zone from edges of watercourses if water voles confirmed present following updated survey work prior to decommissioning. Sensitive temporary lighting design to minimise spill (DEMP).	Minor adverse (Not significant)	High

8.12 References

Ref 8-1 The Conservation of Habitats and Species Regulations 2017 (as amended) (SI 2017/1072). London: The Stationery Office.

Ref 8-2 Wildlife and Countryside Act 1981 (as amended) (SI 1981 c. 39). London: The Stationery Office.

Ref 8-3 Natural Environment and Rural Communities Act 2006 (SI 2006 c. 16). London: The Stationery Office.

Ref 8-4 Protection of Badgers Act 1992 ((SI 1992 c. 51)). London: The Stationery Office.

Ref 8-5 The Hedgerow Regulations 1997 (SI 1997/1160). London: The Stationery Office.

Ref 8-6 The Invasive Alien Species (Enforcement and Permitting) (Amendment) Order 2019 (SI 2019 No. 1213).

Ref 8-7 Department for Transport (2012) National Policy Statement for Ports. London: The Stationery Office.

Ref 8-8 Department of Energy & Climate Change (2011) Overarching National Policy Statement for Energy (EN-1). London: The Stationery Office.

Ref 8-9 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework. London: Ministry of Housing, Communities and Local Government.

Ref 8-10 Natural England and Defra (2022) Protected Species and Development: Advice for Local Planning Authorities.

Ref 8-11 Forestry Commission and Natural England (2018). Ancient woodland, ancient trees and veteran trees: protecting them from development

Ref 8-12 Lincolnshire Biodiversity Partnership (2011) Lincolnshire Biodiversity Action Plan 2011-2020 (3rd Edition). Horncastle: Lincolnshire Biodiversity Partnership.

Ref 8-13 Natural England (2022) Multi-Agency Geographic Information for the Countryside (MAGIC) website.

Ref 8-14 Natural England (2022) Designated site website. Available online at https://designatedsites.naturalengland.org.uk/

Ref 8-15 Joint Nature Conservation Committee (2016) Handbook for Phase 1 habitat survey – a technique for environmental audit. Peterborough: Joint Nature Conservation Committee.

Ref 8-16 Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). London: The Bat Conservation Trust.

Ref 8-17 Dean, M., Strachan, R., Gow, D. & Andrews, R., (2016) The Water Vole Mitigation Handbook. London: The Mammal Society.

Ref 8-18 Amphibian and Reptile Groups of the United Kingdom (2010) ARG UK Advice Note 5 Great Crested Newt Habitat Suitability Index. Amphibian and Reptile Groups of the United Kingdom.

Ref 8-19 Department for Environment, Food & Rural Affairs (2022) Keepers of time: ancient and native woodland and trees policy in England

Ref 8-20 CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland – terrestrial, Freshwater, Coastal and Marine. CIEEM, Winchester.

Ref 8-21 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 9: Nature Conservation (Marine Ecology)

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 9: Nature Conservation (Marine Ecology)

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

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Revision 1	21 September 2023	DCO Application

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Appendix 9.B: Underwater Noise Assessment [**TR030008/APP/6.4**]

9. Nature Conservation (Marine Ecology)

9.1 Introduction

9.1.1 This chapter of the Environmental Statement ("ES") presents the findings of the assessment of the likely significant effects of the Project on Marine Ecology. This chapter sets out the assessment methodology used, the datasets used to inform the assessment, an outline of baseline conditions, and sets out the likely significant effects the Project will have on marine ecology receptors.

9.1.2 The following receptors have been considered as part of the assessment:

a. Nature conservation designations and protected species.

b. Benthic habitats and species.

c. Fish.

d. Marine mammals.

9.1.3 There are no classified commercial shellfish (bivalve) beds in the Humber Estuary (Ref 9-1) and the areas around the Project and possible disposal sites do not support other commercial shellfisheries (such as crab/lobsters using creels or the collection of whelks). On this basis, commercial shellfisheries have, therefore, been scoped out of the assessment. Relevant fauna which are considered shellfish species (such as cockles or clams), however, are considered within the benthic habitats and species assessment.

9.1.4 Phytoplankton has also been scoped out of the assessment as while phytoplankton can be sensitive to changes in water quality, the predicted magnitude of potential changes in suspended sediments and contamination levels in the water column (as summarised in **Chapter 16: Physical Processes** and **Chapter 17: Marine Water and Sediment Quality**, respectively **[TR030008/APP/6.2]**) are not considered to be at a level which would cause lethal or sub-lethal effects in plankton. On this basis, phytoplankton has been scoped out of the assessment.

9.1.5 There may be interrelationships related to the potential effects on Marine Ecology and other disciplines. Therefore, also refer to the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 6: Air Quality**

b. **Chapter 10: Ornithology**

c. **Chapter 16: Physical Processes**

d. **Chapter 17: Marine Water and Sediment Quality**

9.1.6 Relevant aspects of the nature conservation and marine ecology assessment presented in this chapter have informed the Water Framework Directive ("WFD") Assessment, presented in **Appendix 18.A [TR030008/APP/6.4]** and also the **Shadow Habitats Regulations Assessment** ("HRA") **[TR030008/APP/7.6]**.

9.1.7 This chapter is also supported by the following figures and appendices:

a. **Figure 9.1:** Project specific subtidal benthic sampling stations **[TR030008/APP/6.3]**

b. **Figure 9.2:** Internationally and nationally designated conservation sites **[TR030008/APP/6.3]**

c. **Figure 9.3:** Spawning and nursery grounds of commercial fish species **[TR030008/APP/6.3]**

d. **Figure 9.4:** TrAC fish monitoring stations in the vicinity of the Project [**TR030008/APP/6.3]**

e. **Figure 9.5:** Annual grey seal pup counts at Donna Nook (Source: Ref 9-64) **[TR030008/APP/6.3]**

f. **Figure 9.6:** Aerial counts of grey seals at Donna Nook (Source: Ref 9-64) **[TR030008/APP/6.3]**;

g. **Figure 9.7:** Harbour porpoise sightings in the Humber Estuary since 2000 (Source: Ref 9-30) **[TR030008/APP/6.3]**

h. **Appendix 9.A:** Benthic Survey Report **[TR030008/APP/6.4]**

i. **Appendix 9.B:** Underwater Noise Assessment **[TR030008/APP/6.4]**

9.2 Consultation and Engagement

9.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the Marine Ecology assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on Marine Ecology. A Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) was adopted by the Secretary of State on 10 October 2022.

9.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ('2008 Act'). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

9.2.3 As a result of consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the second Statutory consultation.

9.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion **(Appendix 1.B [TR030008/APP/6.4])** and in response to the formal consultation and other pre-application engagement is summarised in **Table 9-1**. The full responses to consultation comments are included within the **Consultation Report [TR030008/APP/5.1].**

Table 9-1: Consultation summary table

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Environment Agency	Paragraph 8.2 makes no mention of pelagic ecology, in particular phytoplankton communities – these should be considered (even if they are scoped out) as there is a pathway for impact on this ecological element for example, as a result of sediment resuspension, contaminant release, changes to hydromorphology (these are highlighted in the physical processes and water quality sections). Neither is there any explicit mention of saltmarsh baseline data (although saltmarshes are discussed in the 'current baseline' sections). The Environment Agency holds saltmarsh data for the Humber Transitional waterbodies. We recommend the Applicant search on the Environment Agency's Ecology and Fish data explorer to see if additional data are available at https://environment.data.gov.uk/ecology/explorer/ We are satisfied with the survey rationale outlined in section 8.3.	Scoping opinion noted. Phytoplankton has been scoped out of the assessment as while phytoplankton can be sensitive to changes in water quality, the predicted magnitude of potential changes in suspended sediments and contamination levels in the water column (as summarised in **Chapter 16**: **Physical Processes** and **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2],** respectively) are not considered to be at a level which would cause lethal or sub-lethal effects in plankton. On this basis, phytoplankton has been scoped out of the assessment. Further baseline saltmarsh data has been provided in **Section 9.6.**
Scoping Report August 2022	Planning Inspectorate	The Scoping Report states that there are no classified commercial shellfish (bivalve) beds in the Humber Estuary and the areas around the Proposed Development and dredged sediment disposal sites do not support other commercial shellfisheries (such as crab/ lobsters using creels or the collection of whelks) and therefore seeks to scope out impacts on commercial shellfisheries. The Inspectorate agrees	Scoping opinion noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		that this matter can be scoped out of the assessment on this basis.	
Scoping Report August 2022		The Scoping Report states that the amount of sediment that settles out of suspension back onto the seabed as result of piling is expected to be negligible and benthic habitats and species are not expected to be sensitive to this level of change. The Inspectorate agrees that this impact pathway is not likely to have a significant effect and can be scoped out.	Scoping opinion noted.
Scoping Report August 2022		The Scoping Report states that the pile structures have the potential to result in changes to hydrodynamic and sedimentary processes but such effects are anticipated to be negligible and highly localised (which would be confirmed by the physical processes assessment) and marine habitats and species are not expected to be sensitive to this level of change. The Inspectorate does not agree that this matter should be scoped out of the assessment as there is insufficient evidence that changes to hydrodynamic and sedimentary processes would not have any adverse significant effects	Scoping opinion noted. The assessment has confirmed that the effects of changes to hydrodynamic and sedimentary processes are highly localised (see **Chapter 16**: **Physical Processes [TR030008/APP/6.2]**) This pathway is considered in **Section 9.8**.
Scoping Report August 2022		The Scoping Report states that the expected negligible, highly localised and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) associated with bed disturbance during piling is considered unlikely to produce adverse effects in any marine species. The Inspectorate agrees that this	Scoping opinion noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		impact pathway is not likely to have significant adverse effects on marine species.	
Scoping Report August 2022		The Scoping Report proposes to scope impacts on fish from the capital dredge and disposal on the basis that the scale of the predicted changes are unlikely to cause anything more than negligible changes to fish habitats (feeding, spawning and nursery areas). The Inspectorate does not agree that this matter should be scoped out as changes in water and sediment quality during capital dredging and dredge disposal have been scoped into the assessment and there is insufficient evidence in the Scoping Report to demonstrate that changes to hydrodynamic and sedimentary processes would not have any adverse significant effects on fish habitats.	Scoping opinion noted. Direct effects of the capital dredge and disposal on fish habitats are assessed in **Section 9.8.** Indirect effects due to hydrodynamic and sedimentary processes have been screened out as the predicted changes are not expected to modify existing subtidal habitat types found in the area. Indirect effects on fish habitats (feeding, spawning and nursery areas) are, therefore, considered to be negligible. Further information and justification on this is provided in **Table 9-17.**
Scoping Report August 2022		The Scoping Report proposes to scope out an assessment of impacts on marine mammals as a result of changes to marine mammal foraging habitat and prey resources on the basis that the footprint of the Project only covers a highly localised area that constitutes a negligible fraction of the known ranges of local marine mammal populations. Given the limited scale of the area affected, the Inspectorate agrees that this matter can be scoped out of the assessment.	Scoping opinion noted.
Scoping Report August 2022		The Scoping Report proposes to scope out the potential for disturbance to hauled out seals on the basis of the distance between breeding populations and haul out sites to the proposed works (i.e. the closest haul out site is observed to be on the north	Scoping opinion noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		bank of the Humber Estuary, 3-4km from the dredge disposal sites and 4km from the DCO boundary). Given the large distances involved, the Inspectorate agrees that this matter should be scoped out of the assessment.	
Scoping Report August 2022		Impacts from vessels involved in construction and dredging activity are proposed to be scoped out on the basis that they would mainly be stationary or travelling at low speeds, making the risk of collision low. The Inspectorate agrees that this matter can be scoped out of the assessment on the basis that the collision risk is low and is not likely to have any adverse significant effects on marine mammals.	Scoping opinion noted.
Scoping Report August 2022		The Scoping Report proposes to scope out water quality impacts arguing that (1) the changes in suspended sediment levels would be localised, temporary and unlikely to result in adverse effects on marine mammals; (2) they are adapted to highly turbid conditions, and (3) contamination levels would be unlikely to produce lethal effects in these highly mobile species. In the absence of further data regarding sediment contamination levels and the potential water quality effect of the capital dredge, the Inspectorate is unable to scope this matter out of the assessment.	Scoping opinion noted. A more detailed rationale for scoping out water quality effects on marine mammals has been provided in **Table 9-17**.
Scoping Report August 2022		The Scoping Report proposes to scope out the potential for visual disturbance to hauled out seals because of the distance between breeding populations and haul out sites to the proposed	Scoping opinion noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		works. The Inspectorate agrees that this matter can be scoped out of the assessment on this basis.	
Scoping Report August 2022		The Scoping Report proposes to scope out this matter owing to the existing heavy shipping traffic and anticipated slow speeds of operational vessels (including maintenance dredging/ dredge disposal). The Inspectorate agrees that this matter can be scoped out of the assessment on the basis that the collision risk is low and is not likely to have any adverse significant effects on marine mammals.	Scoping opinion noted.
Scoping Report August 2022		In addition to the Humber Estuary European sites, the Proposed Development may also impact on the Greater Wash SPA and this should be considered within the ES.	Noted. The Special Protection Area ("SPA") is considered **Chapter 10: Ornithology [TR030008/APP/6.2]** of the ES.
Scoping Report August 2022		In addition to the assessment of the direct loss of intertidal and subtidal habitats and species as a result of the piles, the ES should also assess the potential for direct changes to benthic habitats and species underneath the raised pier structures, to determine their effect on the ecological function of the mudflats beneath.	Scoping opinion noted. Direct changes to benthic habitats and species underneath the raised pier structures have been scoped in and assessed in the operational phase (as the built infrastructure has the potential to result in this pathway).
Scoping Report August 2022		The impact of sediment resuspension and hydro-morphological changes on pelagic ecology receptors such as phytoplankton should be considered in the assessment of effects, unless otherwise robustly justified and agreed with relevant consultation bodies.	Phytoplankton has been scoped out of the assessment as while phytoplankton can be sensitive to changes in water quality, the predicted magnitude of potential changes in suspended sediments and contamination levels in the water column (as summarised in **Chapter 16: Physical Processes** and **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** respectively) are not considered to be at

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
			a level which would cause lethal or sub-lethal effects in plankton.
Scoping Report August 2022	Natural England	The development site is within or may impact on the following European/internationally designated nature conservation site(s): •Humber Estuary Special Area of Conservation (SAC); •Humber Estuary Special Protection Area (SPA); •Humber Estuary Ramsar site. •Greater Wash Special Protection Area (SPA) Natural England broadly agrees with this section of the Scoping Report which detail the potential impact pathways on the designated sites during both construction and operation phases of the proposed development.	Scoping opinion noted.
Scoping Report August 2022		In addition, in the benthic habitats and species sections [with reference to Paragraph 8.4.4 (a) of the Scoping Report], we advise that direct changes to benthic habitats and species underneath the raised pier structures should also be assessed, to determine if it could affect the ecological function of the mudflats beneath. Natural England do not concur with the conclusion [with reference to Paragraph 8.4.4 (b) of the Scoping Report that Indirect changes to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes due to the capital dredge and disposal should be scoped out for fish] when 'Changes in water and sediment quality during	Direct changes to benthic habitats and species underneath the raised pier structures have been scoped in and assessed in the operational phase (as the built infrastructure has the potential to cause effects for this pathway). An assessment of effects for this pathway is provided in **Section 9.8**. The predicted changes in hydrodynamic and sedimentary processes are very small. Based on modelling results (see **Chapter 16**; **Physical Processes [TR030008/APP/6.2]**) and an understanding of the baseline conditions for fish it is very unlikely there would be any potential for effects on fish habitats (feeding, spawning and nursery areas) (see **Table 9-17**).

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		capital dredging and dredge disposal' have been scoped in. We would seek further clarification on this.	
Scoping Report August 2022		Impacts that maintenance dredging will have refer to notified feature having no sensitivity due 'to the scale of changes in SSC anticipated during capital dredging' [with reference to Paragraph 8.4.6 (a) (iii)]. These are two very different impacts therefore Natural England advise further consideration is given to the impacts of maintenance dredging will have on water quality.	The potential for impacts on water quality to affect marine mammals during capital dredging and disposal have been considered (see **Table 9-17**). The predicted changes in water quality during the capital dredge and disposal are negligible. Given that the maintenance dredging will be on a much smaller scale than capital dredging there are no anticipated effects.
Scoping Report August 2022		Natural England welcome the commitment to determine mitigation measure through the statutory consultation process.	Scoping opinion noted.
Statutory Consultation (PEIR) January – February 2023	Natural England	**Chapter 9: Nature Conservation (Marine Ecology) Marine ecology related comments in Chapter 2: The Project** Natural England notes the change in design plans to include two berths on the jetty instead of a single berth as stated in Chapter 2: The Project (paragraph 2.4.38). However, we consider that the creation of another berth may have additional impacts and should be assessed. Natural England welcomes the inclusion of the impact of maintenance dredging on the marine environment in the Environmental Statement as stated in Chapter 2: The Project (paragraph 2.4.5f). We note that the capital dredge methodology has not yet been finalised for this project (paragraph 2.6.4). We also note that the exact the marine construction	Noted. **Chapter 2: The Project [TR030008/APP/6.2]** of the ES provides a full description of the Project. Only a single berth is now proposed. The remainder of this comment has been noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		methodology and sequencing for the marine works is still being developed (paragraph 2.6.6). Therefore, the comments below are on the basis of current available information and may be subject to change as more details on the project are provided.	
Statutory Consultation (PEIR) January – February 2023	Natural England	<u>Assessment of impacts on benthic habitats and species</u> At this time, Natural England have not fully considered the potential impacts on benthic habitats and species, and we will provide detailed comments on the ES. However, we have some initial comments below.	Noted.
Statutory Consultation (PEIR) January – February 2023	Natural England	<u>Potential effects from permanent direct loss of intertidal and subtidal habitat during construction and operation phases</u> Natural England notes that the proposed development will result in loss of 0.017 ha of intertidal habitat as a result of the proposed jetty piles. In addition, it is noted that piling activities will result in a direct loss of 0.035 ha of subtidal habitat. Natural England advises that the assessment considers the potential for adverse effects as a result of loss of both intertidal and subtidal habitat. This should include the combined loss of SAC habitat (i.e., Estuaries and Mudflats and sandflats not covered by seawater at low tide) as well as the loss of supporting habitat for SPA bird species. Natural England considers that any credible risk of a measurable loss of marine or terrestrial habitat, no	Habitat loss values have been updated to reflect the latest scheme design. The assessment has considered the potential for adverse effects as a result of loss of both intertidal and subtidal SAC habitat **(Section 9.8** of this chapter**)** and supporting habitat for SPA bird species (Section 10.8 of **Chapter 10: Ornithology [TR030008/APP/6.2]**). Noted. Loss of marine and terrestrial from within a European site has been screened-in for further assessment in the Appropriate Assessment as part of the **Shadow HRA [TR030008/APP/7.6]).**

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		matter how small, from within a European site is a 'likely significant effect' and the full significance of its impact on site integrity should be screened-in and further tested by an Appropriate Assessment. It is Natural England's advice that a lasting and irreparable loss of European Site habitat will prevent a conclusion of no adverse effect on site integrity being reached, unless an Appropriate Assessment can clearly demonstrate it is ecologically inconsequential. Furthermore, the appropriate assessment should be made in view of the European sites' conservation objectives, which provides a list of attributes contributing to site integrity that can provide a checklist for the assessment process, the detailed supplementary advice and advice on operations should also inform the conclusion.	The Information to support the Appropriate Assessment in the **Shadow HRA [TR030008/APP/7.6])** has been prepared in view of the European sites conservation objectives which has been used as a basis for the assessment. The supplementary advice and advice on operations has also been used to inform the conclusion.
Statutory Consultation (PEIR) January – February 2023	Natural England	Potential effects from capital and maintenance dredging and disposal of dredged material to sea during construction and operation phases. During the construction phase, potential changes to benthic habitats and species as a result of the proposed capital dredge have been scoped in, on the basis that dredging could result in changes in species' abundance and distribution through damage, mortality or relocation to a disposal site. It is not clear why the same impact pathway has been scoped out for the proposed maintenance dredging. In addition, Table 9.12 acknowledges that the predicted impacts on benthic ecology receptors as a result of maintenance dredging could be equivalent	Noted. Changes to benthic habitats and species as a result of removal of sediment during maintenance dredging have been scoped into the assessment. Noted. Changes to benthic habitats and species as a result of removal of sediment during maintenance dredging has been scoped into the assessment. This has considered the expected frequency of maintenance dredging to better understand potential recoverability.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		to the predicted impacts as a result of the capital dredge regime. We consider that changes in species' abundance and distribution are also possible during the maintenance dredging through the same mechanisms identified for the capital dredge. In addition, paragraph 9.7.25 states that the infaunal community could re-establish themselves in less than 1-2 years, however it is unclear whether the benthic community in the area of seabed requiring periodic maintenance dredging would have the ability to recover as the frequency of this dredging activity has not been provided. In addition, we also consider that the statement "Subtidal habitats in areas around the Port of Immingham are considered to be typically of limited ecological value" is not a suitable justification for scoping out the impact of maintenance dredging regarding changes to benthic habitats and species. Subtidal muddy sand, which primarily constitutes the project area, is a sub-type of the Annex I notified feature "H1110 Sandbanks which are slightly covered by sea water all the time" and is part of the Humber Estuary SAC. Therefore, this should be scoped into the assessment.	The assessment has considered the subtidal habitat in the dredge footprint as a component of the 'Estuaries' feature rather than 'Sandbanks which are slightly covered by sea water all the time' as the project specific benthic grab samples recorded mud sediment types (mud or sandy mud) rather than being characterised by predominantly sand sediment fractions.
Statutory Consultation (PEIR) January – February 2023	Natural England	Natural England notes that a maintenance dredging protocol has not been referred to within the PEIR. Natural England continues to support the production (including reviews) of Maintenance Dredge Protocols (MDP) as industry best practice, providing a foundation for consistent and informed decision making by all competent authorities. The MDP provides a strategic approach to considering the	Noted. The Maintenance Dredge Protocols ("MDP") for the Humber Estuary (Ref 9-139) has been considered as a basis for the assessment for maintenance dredging.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		impacts of maintenance dredge activity within a defined port or estuary and can support demonstration of compliance with The Conservation of Habitats and Species Regulations 2017 as amended (The Habitats Regulations). It also negates the need to produce an environmental assessment for individual consent applications, thereby providing efficiencies through the consenting process. This enables a clear baseline and audit trail for compliance with the Habitats Regulations to support dredging activities (and any potential marine licence applications as required) for all statutory harbour authorities in the area.	
Statutory Consultation (PEIR) January – February 2023	Natural England	We note that ABP will be undertaking site-specific sediment sampling to establish the likelihood of remobilisation of contaminated sediment. We acknowledge that the assumptions within the PEIR are based upon previous surveys undertaken at the Immingham site which were found to be low. However, until the survey data confirms this, this impact pathway cannot be ruled out. As a result, therefore NE cannot agree with the conclusion reached in paragraph 9.7.54 as the sampling results will inform the assessment.	Noted. The assessment has been based on the project-specific sediment contamination survey results.
Statutory Consultation (PEIR) January – February 2023	Natural England	<u>Assessment of impacts on Sea and River Lamprey (migratory fish) during the construction phase</u> The following advice is provided on the assumption that the underwater noise modelling used in the assessment in Appendix 9B is correct and we defer to Cefas advice as to the accuracy of the modelling.	Noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		NE note in paragraph 9.8.1, that there are a number of mitigation measures being considered for fish and marine mammals including "the use of soft start procedures, the use of vibro piling where possible with seasonal/night time piling restrictions specifically for migratory fish species and JNCC piling protocols for marine mammals" it also states that these mitigation measures would be further developed, if required, through ongoing engagement with statutory authorities as part of the statutory consultation process and taking into account the final scheme design information and latest understanding of potential effects. We agree that the mitigation set out would be effective in reducing impacts to migratory fish and should be considered within the assessment. The outcome of the HRA will identify the mitigation required. We welcome the commitment to engage with Natural England to further develop mitigation measures considering the final design and understanding of potential effects.	Noted. Mitigation requirements **(Section 9.9**) for fish have been developed as part of the assessment process (including the Shadow HRA **[TR030008/APP/7.6]**) and through engagement with statutory authorities.
Statutory Consultation (PEIR) January – February 2023	Natural England	<u>Assessment of impacts on marine mammals during construction and operation phases</u> As above, the following advice is provided on the assumption that the modelling used in the underwater noise assessment in Appendix 9B is correct and we defer to Cefas advice as to the accuracy of the modelling. NE broadly agrees with the scope of the assessment during the construction phase of the project.	Noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Nonetheless, we advise that the assessment should reflect the key impact parameters including hammer energy, pile diameter, timing, and duration. An assessment based on these parameters should present the ranges/zones of injury and disturbance to marine mammals. The number of animals predicted to be within the impact zones should be determined and presented as a proportion of the relevant reference population (e.g., Management Unit population for EIA purposes). Note that we consider it likely that marine mammals could be within the construction impact zones, based on their highly mobile nature and the evidence presented by the Application such as the sightings of harbour porpoise approximately 2km from the project area and grey seals are regularly recorded foraging in the Immingham area. Once the risk of exposure is identified, appropriate mitigation should be considered. The outcome of the HRA will identify the mitigation required. We welcome the commitment to engage with Natural England to further develop mitigation measures considering the final design and understanding of potential effects.	The assessment has been based on the results of the underwater noise modelling and has taken into account factors such as marine piling method, pile diameter, duration. Mitigation has been developed based on an understanding of the population ecology of the marine mammal species in the area. Where possible a broad estimation of the number of animals predicted to be within the potential zone of effect of marine piling has been determined and presented as a proportion of the relevant reference population (e.g., Management Unit population). Mitigation requirements for marine mammals have been developed as part of the assessment process (including the **Shadow HRA [TR030008/APP/7.6]**) and through engagement with statutory authorities.
Pre-application meeting, 23 November 2022.	Natural England	The meeting provided an update of the IGET project, a summary of the future site-specific surveys and a high-level discussion of potential effects.	This chapter (**[TR030008/APP/6.2]**) and the **Shadow HRA**(**[TR030008/APP/7.6]**) have been completed taking on board consultee comments from the meeting.
Pre-application meeting, 11 January 2023	Natural England	The meeting provided a further update of the Project as well as a discussion on potential effects, HRA, stakeholder engagement and project programme.	This chapter and the **Shadow HRA** (**[TR030008/APP/7.6]**) have been completed taking on board consultee comments from the meeting.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Statutory Consultation (PEIR) January – February 2023	Environment Agency	Chapter 9 of the PEI Report provides detailed background/baseline information for fish. The entrainment and/or removal of fish and fish eggs during dredging activities have been scoped into Table 9.11. This has then been ruled out for needing further assessment in the section 9.7.78. However, this fails to consider the potential impacts of dredging on fish (entrainment and/or removal of fish) such as juvenile eel and lamprey living in sediments, which are unlikely to be able to escape the works. Measures may therefore be needed to minimise the impacts of dredging operations on fish and should be scoped into further assessment unless suitable justification is provided.	Section 9.7.78 of the PEI Report did not rule out the potential for entrainment and/or removal of fish which was considered as part of the 'Direct loss or changes to fish populations and habitat as a direct result of dredging and dredge disposal' and has been considered as part of the assessment **(Section 9.8)**.
Statutory Consultation (PEIR) January – February 2023	Lincolnshire Wildlife Trust	Given the extent of dredging and marine construction described in the PEI Report, it is prudent that the Applicant properly evaluates potential impacts on features within the Humber Estuary. This would require, current, site-specific data on distributions of species of interest in the local and surrounding areas. While the Applicant has provided several sources to help establish a baseline, LWT would argue that several of these datasets are not current (older than five years) or are too far to be relevant to the local area in question (questionable data sources listed below). While these datasets may be used to help establish a historic baseline and understanding for expected species, LWT does not feel that these datasets alone are sufficient to determine an ecological baseline or to directly inform potential impacts and mitigation for the proposed project.	With respect to benthic data, project specific benthic data (grab samples) were collected from within and near the potential development footprint in 2022. All the faunal samples collected over the survey area were very impoverished in nature with commonly occurring species recorded and assemblages similar to recent previous samples collected nearby for the proposed Immingham Eastern Ro-Ro Terminal (“IERRT”) project in 2021 (<0.5-1km away). Based on an understanding of the subtidal ecology of the local area more generally, the samples are considered representative of the impoverished subtidal communities found in this section of the Humber Estuary which are subject to physical disturbance as a result of strong tidal currents and sediment movement. On this basis there is considered to be no requirement for the collection of any additional benthic samples. With respect to fish data, it is acknowledged that some of the data sources are more than five years old, and while relatively

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Therefore, these historic datasets would need to be supplemented with more current, site-specific data. Benthic datasets older than five years: · Able Marine Energy Park Benthic Surveys (2015 and 2016) · Humber Estuary SAC Intertidal Sediment Survey (2014) · South Humber Channel Marine Studies (2010) · HU056 Disposal Site Monitoring (2017) · Clay Huts Disposal Benthic Monitoring (2008) Fish datasets older than five years: · South Humber Channel Marine Studies (2010) · EA TraC Fish Monitoring (2017) · EA Review of fish population data (2013 – used for fish species records presented in Tables 9.7 and 9.8) · Ref 9-28 – Spawning and nursery grounds (2012 – used for fish species records presented in Tables 9.7 and 9.8)	near to the development footprint, do not directly overlap. However, given the wide variety of surveys and studies undertaken on fish in the region as well as the mobile nature of fish, the surveys are considered broadly representative of the fish assemblage that could be present within the dredge footprint and surrounding local area. Furthermore, based on an understanding of potential impacts it is diadromous migratory fish (which would not be targeted by fish survey methods in the development footprint) rather than other fish species which are considered most likely to be sensitive to potential impacts. On this basis, site-specific data fish data is not considered to be needed to inform the assessment.
Statutory Consultation (PEIR) January – February 2023	Lincolnshire Wildlife Trust	The dynamic and localised nature of benthic ecology necessitates comprehensive, localised data to properly establish a baseline for ecological assessment. Furthermore, data outside the proposed Site Boundary would likely be required given the type of sediment and extent of dredging and pile-driving that are proposed for this project. LWT recognizes that current data from grab samples have been provided in Appendix 9.A; however we would argue that this level of data is insufficient (Sample size of eight taken during a single day of sampling) to establish a clear understanding of the local and	Project specific benthic data (grab samples) were collected from within and near the potential development footprint in 2022. The scale of the sampling was considered comparable to those undertaken for other recent developments and proportionate based on an understanding of the subtidal assemblages known to occur in the local area. All the faunal samples collected over the survey area were very impoverished in nature with commonly occurring species recorded and assemblages similar to recent previous samples collected nearby for the proposed IERRT project in 2021 (<0.5-1km away). Based on an understanding of the subtidal ecology of the local area more generally, the samples are considered

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		surrounding benthic habitat that is likely to be impacted by such an extensive level of construction and dredging. Therefore, LWT would recommend that further surveys be undertaken prior to approval of dredging and construction.	representative of the impoverished subtidal communities found in this section of the Humber Estuary which are subject to physical disturbance as a result of strong tidal currents and sediment movement. On this basis there is no requirement for the collection of any additional benthic samples.
Statutory Consultation (PEIR) January – February 2023	Lincolnshire Wildlife Trust	LWT appreciates the Underwater Noise report provided in Appendix 9.B. However, we believe that this exercise did not go far enough to properly assess potential risk or impacts to marine fauna. Currently, the assessment only provides noise propagation models for construction/dredging, known hearing sensitivities and responses of marine fauna, and characterisations of proposed development activities. We believe that this exercise could have been improved by modelling species distributions based on current data in conjunction with noise propagation models based on the location and time of year of the construction phase. This type of investigation might be used to quantify potential risk to sensitive species based on the anticipated timing of construction and predicted habitat use, and therefore would be a valuable tool for avoiding/mitigating impacts (e.g. timing construction based on anticipated risk and interaction with sensitive species)	The underwater noise assessment is based on the worst case assumption that any sensitive marine species that are known to occur in the study area (i.e. the Humber Estuary) have the potential to overlap with the underwater noise generated by the proposed development activities. It takes account of the published evidence on marine species' temporal and spatial distribution that is reviewed in this chapter to identify the key species that require to be assessed but it does not attempt to quantify the risk through modelling which is likely to have inherent uncertainties associated with it and potential to misrepresent or underestimate the effects. Furthermore, this approach was not identified as a requirement at the scoping stage of the Project.
Statutory Consultation (PEIR) January – February 2023	Lincolnshire Wildlife Trust	LWT recognizes that marine works (capital dredging and piles) have been scoped in and we will be monitoring further assessments of pile-driving impacts, capital dredging impacts and dredge disposal. We have provided details above that will facilitate assessments of dredging and construction	The scope of dredging requirements has changed since the PEI Report. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). Further information on maintenance dredging has been provided in **Section 9.8**. The assessment considers the impact on habitats of maintenance dredging during the operational

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		impacts. However, we do not agree with the scoping out of maintenance dredging in the operational phase. While the Applicant has claimed that 'the predicted impacts on benthic habitats and species as a result of maintenance dredging are considered to be equivalent or lower than capital dredge and comparable to the existing maintenance dredge regime', it is currently unclear how this proposed maintenance would contribute to cumulative impacts of ongoing works within the Humber Estuary. Therefore, we recommend that maintenance dredging is scoped into further assessment, and that both capital dredging and maintenance dredging are included in future cumulative impact assessments.	phase. Cumulative effects of dredging are considered (**Chapter 25**: **Cumulative and In-Combination Effects of the ES [TR030008/APP/6.2**]).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	While the introduction and spread of invasive non-native species (INNS) will be addressed under the CEMP for the project, the MMO consider the piles that provide support for the jetty and approach trestle to provide suitable structure for the settlement of INNS, such as the leathery sea squirt, *Styela clava,* which has been recorded in the area, and for others yet to be identified. The MMO consider that the impacts of INNS that may recruit on infrastructure should be considered further and included in any monitoring assessment following construction.	Noted. Consideration of the potential for non-natives to colonise piles and other structures has been included within the ES (operational phase, **Section 9.8**).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	For the purpose of the Environmental Statement (ES) it is not appropriate to quantify habitat loss for fish receptors as a percentage of total available habitat. Fish do not use habitat uniformly and may use discrete locations for feeding and spawning activities which will vary from year to year and	The assessment in the ES provides further detail on the individual receptors sensitivities to suspended sediment concentrations ("SSC") and also considers the temporal aspect in terms of how often particularly high background SSC occurs and the timing of this and the spatial aspect and characteristics of the plume in relation to swimming behaviour. Further

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		season to season. At this stage, the MMO does not support the preliminary assessment conclusion that impacts from changes in water and sediment quality as a result of dredging are not significant for fish. The justification for this conclusion is based on the following; fish receptors in the Humber Estuary are anticipated to be well adapted to living in an area with variable and typically high SSC; fish are expected to move to avoid areas of adverse conditions; plumes resulting from dredging and dredge disposal are expected to be localised and short lived due to strong hydrodynamic conditions in the area. Regarding salmonids and other migratory fish, the PEI Report acknowledges that these species can be sensitive to elevated SSC, however it is assumed that they would be able to avoid the sediment plumes. However, the assessment has not considered the effect of high background levels on SSC in-combination with elevated SSC as a result of capital dredging, which would result in SSCs and reduced water quality that exceed background levels.	information is provided on feeding and spawning habitats for sensitive receptors (**Section 9.6**).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	Furthermore, the timing of dredging (and piling) activity has not been discussed in the context of the migratory seasons of diadromous fish. Avoidance of an impacted area by migratory species may not always be possible for some species, particularly those in their juvenile stages or using selective tidal stream transport to move up/downstream from their natal grounds and especially when dredging is proposed on a 24/7 basis. In addition, avoidance of an impacted area can lead to additional stressors such as increased expenditure of energy and	Further information on migration periods of key species and timing of dredging and marine piling operations has been provided alongside more detail on the temporal and spatial characteristics of the dredge plume and on the zone of influence from underwater noise from marine piling (**Section 9.8**).

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		increased respiration which may reduce overall levels of fitness at crucial life stages. The MMO recommend that the final assessment for changes in water and sediment quality in the ES provides consideration of the above comments, particularly in respect of the timing of dredging activity in relation to the timing of the migratory period of fish in the Humber.	
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	Changes to fish populations and habitat due to maintenance dredging and disposal has been scoped out of the ES as the impacts are anticipated to be equivalent to or lower than the capital dredging and comparable to or lower than existing maintenance dredging regime. The maintenance dredge footprint and proposed disposal site are considered unlikely to provide important nursery or spawning functions for fish species as a result of the disturbed nature of these habitats. Whilst the MMO generally agree with this assessment, the scope of the maintenance dredging is yet to be fully determined in the PEI Report, and therefore it is difficult to fully assess the potential impacts. If this is to be equivalent to the planned capital dredging (as stated in the report), then this should be taken forward for further assessment in the upcoming ES.	Further information on maintenance dredging has been provided in **Section 9.8** including an assessment of potential effects relating to this pathway. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	Changes in water and sediment quality due to maintenance dredging and disposal has been scoped out of the ES as changes in water quality are expected to be lower than for capital dredging and similar to existing maintenance dredging. Whilst the MMO generally agree with this assessment, the	Further information on maintenance dredging has been provided in **Section 9.8** including an assessment of potential effects relating to this pathway. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).

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		scale of the maintenance dredging is yet to be clearly stated, but will be set out in the upcoming ES. If the scale of maintenance dredging is to be potentially similar in scale to the capital dredging this should also be taken forward for further assessment within the ES and should be properly characterized and quantified before it can be excluded.	
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	Underwater noise due to maintenance dredge and dredge disposal has been scoped out of the assessment on the basis that under the worst-case scenarios the impact of underwater noise due to dredging activities on fish receptors will be insignificant. The MMO disagree with this statement. Firstly, the underwater noise assessment states that dredging could cause moderate behavioural impacts on all types of fish receptors (physostomous and physoclistous) at the intermediate distances (i.e. hundreds of metres from the source). This might seem insignificant in the contact of the Humber Estuary, however there may be potential for cumulative impacts with other activities. Secondly, if the impacts of underwater noise due to maintenance dredging are anticipated to be similar to capital dredging activities, this should also be taken forward for assessment within the ES.	Further information on maintenance dredging has been provided in **Section 9.8** including an assessment of potential effects relating to this pathway. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The impact of lighting due to vessel operations has been scoped out of the assessment as impacts are expected to be small and localised within the context of the Humber Estuary. The MMO agree with the assessment, however, recommend that where practicable, and safe to do so, lighting should be	Lighting design will be optimised to avoid any unnecessary light-spill on the water or foreshore habitats **(Section 9.8**).

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		directed to best avoid unnecessary light-spill on the water.	
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The report makes a brief reference to the potential limitations of the fisheries surveys data used to inform the assessment. For the ES, the MMO would expect to see limitations such as differing gear selectivity and timings of the surveys explored in more depth in the 'Limitations and Assumptions' section 9.4.3-9.4.6 in Chapter 9 of the PEI Report.	Potential limitations of the fisheries surveys data used to inform the assessment has been included in the Limitations and Assumptions section of this chapter (**Section 9.4**).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The MMO support the proposal to use soft-start procedures on commencement of piling. Soft-start procedures, in accordance with JNCC guidelines (Ref 9-18) should be adopted as part of the developers' 'best practice' mitigation. This will enable fish to distance themselves from the source of impact as the sound source gradually increases. However, whilst soft-start measures may allow resident species to leave the area of greatest disturbance (and thereby potentially reducing the total number of dangerous exposures in terms of auditory damage), such measures may not necessarily be appropriate (or of benefit) for migratory species, when the primary concerns is that underwater noise may create a temporary acoustic barrier in the river, impeding travel/migration.	Noted. Suitable mitigation for migratory fish has been developed further in consultation with the Marine Management Organisation ("MMO") and based on underwater noise modelling and further assessment work.
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The MMO appreciate and welcome the suggestion of temporal/seasonal piling restrictions specifically for migratory fish receptors, though no details of these restrictions have been submitted at this point. As mentioned above, the exact dates when piling and	Noted. Suitable mitigation for migratory fish has been developed further in consultation with the MMO and based on underwater noise modelling and further assessment work.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		dredging activities are to take place have not been stated so it is not possible to determine whether seasonal/temporal restrictions will be required for piling or dredging. The requirement for seasonal/temporal mitigation should be determined on the basis of the outcomes of the final EIA and will be subject to the timing of construction activities.	
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	It should be noted that as piling will only occur during daylight hours (7 am to 7 pm) a night-time piling restriction is only likely to be of benefit to those species with nocturnal habitats such as European eel. Whilst a night-time restriction on piling will provide a 12-hour period of quiet 'down-time' for all fish receptors, the proposal to carryout dredging on a 24/7 basis will result in increased noise, increased SSC and reduced water quality, and thus potential impacts to fish receptors during hours of darkness are still a concern.	Noted. Suitable mitigation for migratory fish has been developed further in consultation with the MMO and based on underwater noise modelling and further assessment work with respect to marine piling. The maximum impact marine piling scenario is for three tubular piles to be installed each day using up to two marine piling rigs pile driving at any one time, involving approximately 270 minutes of impact marine piling per day and 60 minutes of vibro marine piling per day in a 12-hour shift. There will, therefore, be significant periods over a 24-hour period when fish will not be disturbed by any marine piling noise. The actual proportion of impact marine piling is estimated to be at worst around 23% (based on 270 minutes of impact marine piling and 60 minutes of vibro marine piling each working day) over any given construction week.
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The information regarding shellfisheries is detailed, relevant and extensive, both in respect of the baseline and the impact assessments conducted. The MMO have identified no significant gaps in respect to shellfisheries.	Noted

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	The MMO note that underwater noise arising from vessel operations maintenance dredge and dredge disposal (during the operational phase) has been scoped out for all marine receptors. Provided that the worst-case dredging assumptions have been considered, then the MMO have no major objections to the scoping out (of a more detailed assessment) of maintenance dredging during the operational phase. Nevertheless, it will still be important to consider any overlap of maintenance dredging operations with key migratory or spawning periods	Further information on maintenance dredging has been provided in **Section 9.8** including an assessment of potential effects relating to this pathway. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).
Statutory Consultation (PEIR) January – February 2023	Marine Management Organisation	Mitigation measures included in the report are the standard measures expected for this type of development. The MMO recommend that soft start procedures are adopted for all percussive piling. Soft start may help to reduce the total number of dangerous exposures in terms of auditory injury. The MMO also support the use of vibro piling where possible. Furthermore, it will be important to identify any overlap of construction works with key migratory and spawning periods. Some seasonal or night time restrictions may be necessary to protect sensitive receptors.	Noted. Suitable mitigation for migratory fish has been developed further in consultation with the MMO and based on underwater noise modelling and further assessment work.
Pre-application meeting, 28 April 2023	MMO and Cefas	The meeting provided an update on the Project and focused on discussing comments received from the MMO and Cefas on the PEIR with respect to potential effects on migratory fish species.	The scope of the environmental assessments has been completed taking on board consultee comments from this meeting.
Second Statutory	Natural England	**Internationally and nationally designated sites**	A **Shadow HRA** has been produced **[TR030008/APP/7.6]** which considers potential effects on the Humber Estuary SAC,

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Consultation May 2023 – July 2023		Natural England notes there have been no amendments to the PEIR Appendix 9C which was provided in the first S42 consultation. The application site is in close proximity to European designated sites (also referred to as Habitat sites), and therefore has the potential to affect their interest features. European sites are afforded protection under the Conservation of Habitats and Species Regulations 2017, as amended (the 'Habitats Regulations'). The application site is within and adjacent to the Humber Estuary Special Area of Conservation (SAC) and Special Protection Area (SPA) which are European sites. The site is also listed as Humber Estuary Ramsar site and notified at a national level as Humber Estuary Site of Special Scientific Interest (SSSI). Our advice regarding the potential impacts upon the Humber Estuary SSSI coincides with our advice regarding potential impacts upon the Humber Estuary SAC/SPA/Ramsar as detailed above. Natural England notes that the application site is in close proximity to the Humber Estuary SSSI and North Killingholme Haven Pits SSSI. Based on the plans submitted, Natural England considers that the proposed development could have potential significant effects on the interest features for which the sites have been notified. The consultation documents provide some screening information for the Habitats Regulations Assessment (Shadow HRA). It is Natural England's advice that the proposal is not directly connected with or	SPA and Ramsar site. Where Likely Significant Effects ("LSEs") were identified at the screening stage of HRA, the relevant impact pathways were taken forward to stage 2 Appropriate Assessment. Marine ecology features of Humber Estuary SSSI are considered in **Section 9.8** and ornithology features of the SSSI in Section 10.8 of **Chapter 10: Ornithology [TR030008/APP/6.2]**. Potential effects on the North Killingholme Haven Pits SSSI are considered in Section 10.8 of **Chapter 10: Ornithology [TR030008/APP/6.2].**

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		necessary for the management of the European site. You should therefore determine whether the proposal is likely to have a significant effect on any European site, proceeding to the Appropriate Assessment stage where significant effects cannot be ruled out.	
Second Statutory Consultation May 2023 – July 2023	Marine Management Organisation	1. Benthic Ecology 1.1. The MMO does not have any concerns relating to benthic ecology arising from the proposed changes to the project as outlined in the PEIR addendum. We agree with the overall conclusions that there will be no changes to the likely significant effects presented in the PEIR for benthic ecology. The MMO notes that the only significant change to the assessment will be in relation to the reduced number and footprint of the piles which is unlikely to result in new or different pathways to impact on benthic receptors. The MMO does not consider the decrease in the number of proposed berths (from two to one) and the change in the marine site boundary to require additional assessment to that of the first PEIR. 1.2. While the introduction and spread of invasive non-native species (INNS) will be addressed under the Construction Environmental Management Plan (CEMP) for the project, the MMO, in consultation with Cefas, consider that the piles which provide support for the jetty would be a suitable structure for the settlement of INNS, such as the leathery sea squirt, Styela clava which has been recorded in the area, and for others yet to be identified. However, the	Noted. Consideration of the potential for non-natives to colonise piles and other structures has been included within the ES (operational phase, **Section 9.8**).

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		MMO recommend that the impacts of INNS that may recruit on infrastructure are considered further and included in any monitoring assessment following construction.	
Second Statutory Consultation May 2023 – July 2023	Marine Management Organisation	3. Fisheries 3.1. The description of the proposed changes to the project generally appear to indicate a reduction in the scale of the project, mainly due to the removal of one of the berths. However, specific details about the reduced width of the jetty are not provided in the report and it is unclear whether the area and volume of material to be removed during capital dredging have changed. Given the reduced scale of the IGET, it would be reasonable to assume that the footprint of the works will be smaller, and that the volume and area of dredging would not increase as a result of the proposed changes. On this basis, the MMO would not expect the likelihood or significance of impacts to fish species to increase as a result of the design changes. 3.2. Nonetheless, the MMO's advice provided at PEIR stage raised a number issues which highlighted concerns with the robustness of the preliminary environmental impact assessment in respect of fisheries, in particular the impacts to fish arising from capital dredging and underwater noise and vibration from piling. Assuming that piling and dredging are still required to construct the IGET project, the EIA should be revisited based on the revised project design, taking into account our	The assessment provided in **Section 9.8** considers both potential effects from dredging and marine piling based on the revised Project design, taking into account our comments raised during the initial consultation on 16 February 2023.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		comments raised during the initial consultation on 16 February 2023.	
Second Statutory Consultation May 2023 – July 2023	Marine Management Organisation	4. Shellfisheries 4.1. The MMO has no additional comments to make regarding potential impacts to Shellfisheries as a consequence of this PEIR addendum.	Noted.
		5.1. In the PEIR addendum there are two proposed changes to the project related to the marine environment. Firstly, the site boundary has been amended in response to the design evolution of the project. The MMO agrees that the reduction of the marine area being used for construction of the green energy terminal should reduce the potential for adverse sound and vibration impacts, but this will be confirmed after the completion of noise modelling for the full environmental impact assessment (EIA). 5.2. Secondly, marine design changes to the green energy terminal include that the jetty will now be reduced from a double to a single berth. Table 7.2 Implications of the proposal changes by topic, details that the potential for vibration effects to the existing jetty to the West is reduced or removed given the revision to the marine works. The MMO considers that piling will be the significant source of underwater noise at the site. The original PEIR outlined several mitigation measures including soft start procedures, the use of vibro piling where possible with seasonal/ night-time piling restrictions	Noted. All comments received from the MMO have been addressed and the updated scheme design has been assessed within this chapter and the underwater noise assessment (**Appendix 9.B [TR030008/APP/6.4]**). The change in marine design will involve the installation of approximately 393 steel tubular piles of varying sizes to support the approach jetty and jetty head. Further details are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and summarised in the underwater noise assessment (**Appendix 9.B [TR030008/APP/6.4]**). Further consideration has been given to the timing of the proposed activities in relation to key migratory or spawning periods. It is not, however, possible to confirm the exact timing and programme for the marine piling and dredging at this stage and the assessment has, therefore, been undertaken on the basis that the works could be undertaken at any time of year. Marine piling restrictions to avoid sensitive periods for migratory fish have been discussed with the MMO and Cefas and are set out in **Section 9.9** of this chapter.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		specifically for migratory fish species and JNCC marine piling protocols for marine mammals. Given the marine design changes outlined in the addendum, we request that the applicant address whether the change in marine design to a single berth also decreases the number of piles planned (in the original PEIR 380 tubular piles were included), or if the same number of piles and piling schedule is planned. 5.3. Furthermore, in previous advice dated 16 February 2023, several comments were raised regarding underwater noise modelling. Subsequently, the MMO, in consultation with Cefas, look forward to reviewing the noise modelling performed in the environmental impact assessment for the updated marine design. 5.4. Previous advice also emphasised that the applicants should review whether the timing of planned dredging and piling operations overlaps any key feeding or spawning periods. The MMO appreciate that the report highlights that during the environmental statement, the mitigation measures associated with the development will be presented. 5.5. Underwater noise is expected to be produced during dredging and piling operations at the site. Overall, the MMO agrees with the conclusions reached in the PEIR addendum that given the limited extent of the changes, no new significant effects are identified due to Underwater Noise. Furthermore, the proposed changes do not alter the conclusions with respect to significant effects identified in the first	

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		statutory consultation. To minimise the potential effects of underwater noise on migratory fishes and marine mammals, the MMO advise appropriate literature is continued to be reviewed (Popper et al., 2014), (National Marine Fisheries Service, 2018) and consider the timing of the proposed activities in relation to key migratory or spawning periods for marine life.	
Second Statutory Consultation May 2023 – July 2023	Lincolnshire Wildlife Trust	LWT is pleased to see that the level of dredging required for the Project has now reduced with the decision to implement one berth instead of two. However, the details of dredging works remain vague at this time, and LWT will continue to monitor this as more information is given. Our concerns regarding capital dredging and maintenance dredging were not addressed in the updated documents for this Second Statutory Consultation. Therefore, we have included our previously stated views in an appendix (Appendix A) to this letter.	Capital dredging is assessed in **Section 9.8**. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). Further information on maintenance dredging has been provided in **Section 9.8**. The assessment considers the impact on habitats of maintenance dredging during the operational phase. Cumulative effects of dredging are considered (**Chapter 25: Cumulative and In-Combination Effects** of the ES **[TR030008/APP/6.2]**).
Pre-application meeting, 01 August 2023.	Natural England	The meeting provided a further update of the Project as well as a discussion on potential effects, HRA, stakeholder engagement and project programme.	This chapter and the **Shadow HRA** (**[TR030008/APP/7.6]**) have been completed taking on board consultee comments from the meeting.

9.2.5 Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) has also confirmed the Applicant's view that significant effects on: phytoplankton; commercial shellfisheries; sediment deposition impacts of marine piling to benthic habitats and species; water quality effects due to marine piling on marine species, impacts to marine mammals as a result of changes to foraging habitat and prey resource; disturbance to hauled out seals; collision risk to marine mammals from vessels involved in construction and dredging are unlikely. Accordingly, these matters have remained scoped out of consideration in the ES.

9.3 Legislation, Policy and Guidance

9.3.1 **Table 9-2** presents the legislation, policy and guidance relevant to the Marine Ecology assessment and details how their requirements will be met.

Table 9-2: Relevant legislation, policy and guidance regarding Marine Ecology

Legislation / Policy / Guidance	Consideration within the ES
Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('The Habitats Directive') (Ref 9-3)	
The Habitats Directive (92/43/EEC) is intended to help maintain biodiversity throughout the EU Member States by defining a common framework for the conservation of wild plants, animals and habitats of community interest. It established a network of Special Areas of Conservation ("SAC") designated by Member States to conserve habitats and species (listed in Annexes I and II).	The Humber Estuary SAC and features are described in **Section 9.6**. Consideration of impacts on SAC habitats and species is provided in **Section 9.8.** A **Shadow HRA** has been produced **[TR030008/APP/7.6].**
Council Directive 2009/147/EC on the conservation of wild birds ('The Birds Directive') (Ref 9-4)	
Directive 2009/147/EC on the conservation of wild birds is known as the 'Birds Directive'. It creates a comprehensive scheme of protection for all wild bird species. The Directive recognises that habitat loss and degradation are the most serious threats to the conservation of wild birds. It, therefore, places great emphasis on the protection of habitats for endangered as well as migratory species (listed in Annex I), especially through the establishment of a coherent network of Special Protection Areas ("SPA"s) comprising all the most suitable territories for these species.	The Humber Estuary SPA and qualifying features are described in **Chapter 10: Ornithology**. Consideration of impacts on coastal waterbirds which are features of these sites are outlined in Section 10.8 of that chapter. A **Shadow HRA** has been produced **[TR030008/APP/7.6].**
The Water Framework Directive 2000/60/EEC (Ref 9-5)	
The Water Framework Directive (2000/60/EEC) ("WFD") establishes a framework for the	The Project (and associated disposal sites) is located within the Humber Lower water body (ID: GB530402609201) (further described in **Chapter 17: Marine Water and Sediment Quality**

Legislation / Policy / Guidance	Consideration within the ES
management and protection of Europe's water resources. The overall objectives of the WFD are to achieve "good ecological and good chemical status" in all inland and coastal waters by 2021 unless alternative objectives are set or there are grounds for time limited derogation. For example, where pressures preclude the achievement of good status (e.g. navigation, coastal defence) in heavily modified water bodies ("HMWB"s), the WFD provides that an alternative objective of "good ecological potential" is set.	**[TR030008/APP/6.2]**. A WFD compliance assessment has been prepared to support the DCO application which includes consideration of several key biological receptors, specifically habitats, fish, protected areas and invasive non-native species ("INNS"). The WFD compliance assessment has derived information provided both in this chapter and other chapters within the ES.
Conservation of Habitats and Species Regulations 2017 as amended ('The Habitats Regulations') (Ref 9-6)	
The Habitats Directive and Birds Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2017 as amended, known as the "Habitats Regulations"[1]. The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European Sites. The Regulations also require the compilation and maintenance of a register of European sites, to include SACs (classified under the Habitats Directive) and SPAs (classified under the Birds Directive). These sites form the Natura 2000 network. These regulations also apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), candidate SACs ("cSAC"), potential Special Protection Areas ("pSPA"), and proposed and existing European offshore marine sites.	**Section 9.6** identifies protected habitats and species. A Consideration of impacts on these receptors is provided in **Section 9.8**. A **Shadow HRA** has been produced **[TR030008/APP/7.6].**This report will inform the consultation process and will aid the Competent Authority[2] in determining whether the Project has the potential for a LSE on the interest features and/or supporting habitat of a European/Ramsar site either alone or in-combination with other plans, projects and activities and, if so, will inform the requirement to undertake an Appropriate Assessment ("AA") of the implications of the proposals in light of the site's conservation objectives and provide information to support the AA undertaken.
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 9-7)	
The Water Framework Directive (2000/60/EEC) is transposed into UK law through the Water Environment (Water Framework Directive) (England	The Project (and associated disposal sites) is located within the Humber Lower water body (ID: GB530402609201) (further described in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**. A WFD compliance

1 Following the UK leaving the EU, the Conservation of Habitats and Species Regulations 2017 have been modified by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

2 The Secretary of State is the Competent Authority for the HRA under the UK Habitats Regulations for this Application.

Legislation / Policy / Guidance	Consideration within the ES
and Wales) Regulations 2017 as amended, known as the Water Framework Regulations[3].	assessment will be prepared to support the Development Consent Order ("DCO") application which includes consideration of several key biological receptors, specifically habitats, fish, protected areas and INNS. The WFD compliance assessment will draw on information provided both in this chapter and other chapters within the ES.
Marine and Coastal Access Act 2009 ("MCAA") (Ref 9-8)	
The MCAA provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment. The MCAA established the Marine Management Organisation ("MMO") as the organisation responsible for marine planning and licensing. The Project will require a Marine Licence for the elements of the works below Mean High Water Springs including dredging, disposal and placing or removing objects on or from the seabed. For NSIPs, the Development Consent Order (DCO) where granted may include provision deeming a marine licence to have been issued under Part 4 of the Marine and Coastal Access Act 2009. The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO.	Information relevant to the marine licensing process has been provided including characterisation of the baseline for key marine ecology receptors (nature conservation sites, protected habitats and species, fish and marine mammals) (**Section 9.6**) and an assessment of impacts (**Section 9.8**). With respect to Marine Conservation Zones ("MCZ"), the Holderness Inshore MCZ is the nearest MCZ to the Project (located approximately 20 km away). This is considered to be beyond the zone of potential effects of the Project and as a consequence, a MCZ Assessment is not considered to be required.
The Planning Act 2008 (PA2008) (Ref 9-9)	
Whilst the MCAA regulates marine licensing for works at sea, section 149A of the Planning Act 2008 enables an applicant for a DCO to include within the Order a Marine Licence which is deemed to be granted under the provisions of the MCAA.	Information relevant to the marine licensing process has been provided including characterisation of the baseline for key marine ecology receptors (nature conservation sites, protected habitats and species, fish and marine mammals) (**Section 9.6**) and a assessment of impacts (**Section 9.8**).
The Wildlife and Countryside Act 1981 ("WCA") (Ref 9-10)	
The WCA is the principal mechanism for the legislative protection of wildlife in Great Britain. The WCA is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention), the Convention on	**Section 9.4** identifies habitats and species which are protected under the WCA. Consideration of impacts on these receptors is provided in **Section 9.8**.

[3] Following the UK leaving the EU, the main provisions of the WFD have been retained in English law through The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

Legislation / Policy / Guidance	Consideration within the ES
the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Birds Directive (79/409/EEC) and the Natural Habitats and Wild Fauna and Flora Directive (92/43/FFC) are implemented in Great Britain. The WCA applies to the terrestrial environment and inshore waters (0 to 12 nautical miles) and concerns the protection of wild animals and the designation of protected areas, including SSSIs.	
The Countryside and Rights of Way Act 2000 ("CroW Act") (Ref 9-11)	
The CroW applies to England and Wales only. Part III of the CroW Act deals specifically with wildlife protection and nature conservation. The CroW Act places a duty on the Government to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps **should** be taken or promoted, in accordance with the Convention on Biological Diversity. Schedule 9 of the CroW Act amends the SSSI provisions of the WCA, including increased powers for the protection and management of SSSIs. The provisions extend powers for entering into management agreements; place a duty on public bodies to further the conservation and enhancement of SSSIs; increase penalties on conviction where the provisions are breached; and include an offence whereby third parties can be convicted for damaging SSSIs.	**Section 9.6** identifies habitats and species for which SSSIs have been designated. Consideration of impacts on these receptors is provided in **Section 9.8**.
Natural Environment and Rural Communities Act 2006 ("NERC Act") (Ref 9-12)	
The NERC Act came into force in October 2006. In addition to establishing Natural England ("NE") as the body responsible for conserving, enhancing, and managing England's natural environment, the Act also made amendments to both the Wildlife and Countryside Act 1981 and the CroW Act 2000. For example, it extended the CroW Act's biodiversity duty to public bodies and statutory undertakers,and altered enforcement powers in connection with wildlife prosecution. In addition to this, the NERC Act contains a number of additional measures designed to help streamline delivery and simplify the legislative framework, such as changes to the remit and constitution of the Joint Nature Conservation Committee ("JNCC"), reconstitution of the Inland Waterways Amenity Advisory Council, and improving the governance arrangements for the National Parks.	**Section 9.6** identifies habitats and species for which are protected under the NERC Act (priority species and habitats of principal importance). Consideration of impacts on these receptors is provided in **Section 9.8**.

Legislation / Policy / Guidance	Consideration within the ES
Section 41 of the NERC Act requires the SoS to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with NE, as required by the NERC Act.	
The Eels (England and Wales) Regulations (2009) (Ref 9-13)	
The Eels (England and Wales) Regulations 2009 implement Council Regulation (EC) No 1100/2007 of the Council of the European Union, establishing measures for the recovery of the stock of European eel. This includes the requirement to notify the Environment Agency of the construction, alteration or maintenance of any structure likely to affect the passage of eels and where any such structure exists, the requirement to construct and operate an eel pass to allow the free passage of eels.	**Section 9.6** provides background information on European eel in the vicinity of the Project and outlines their ecology and distribution. Consideration of impacts on European eel is provided in **Section 9.8.**
National Policy Statement for Ports (Ref 9-14)	
The National Policy Statement for Ports ("NPSfP") provides the framework for decisions on proposals for new harbour facility developments that constitute an NSIP. This policy requires that in order to meet the requirements of the Government's policies on sustainable development, new port infrastructure **should** also, amongst other things, preserve, protect and where possible improve marine and terrestrial biodiversity, be adapted to the impacts of climate change and provide high standards of protection for the natural environment. As highlighted in paragraphs 5.1.4 and 5.1.5 of the NPSfP, where the development is subject to EIA, the applicant **should** ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. As highlighted in paragraphs 5.1.8 and 5.1.9 of the NPSfP, developments **should** aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. They **should** also ensure that appropriate weight is attached to designated sites of international, national and local importance.	Consideration of impacts on species and habitats including those which are features of internationally, nationally and locally designated sites of ecological importance are presented in **Section 9.8.** Where appropriate, mitigation has been included and this is outlined in **Section 9.9**.

Legislation / Policy / Guidance	Consideration within the ES
UK Marine Policy Statement (Ref 9-15)	
The UK Marine Policy Statement ("MPS") is the framework for preparing marine plans and taking decisions affecting the marine environment. The MPS also sets out the general environmental, social and economic considerations that need to be taken into account in marine planning and provides guidance on the pressures and impacts that decision makers need to consider when planning for and permitting development in the UK marine areas. Paragraphs 3.1.7 and 3.1.8 of the MPS are relevant to the ecology assessment of the Project which, amongst other things, state that: "Marine plan authorities and decision makers **should** take account of how developments will impact on the aim to halt biodiversity loss and the legal obligations relating to all MPAs, their conservation objectives, and their management arrangements…" Marine plan authorities and decision-makers **should** take account of the regime for MPAs and comply with obligations imposed in respect of them. This includes the obligation to ensure that the exercise of certain functions contribute to, or at least do not hinder, the achievement of the objectives of an MCZ. This would also include the obligations in relevant legislation relating to SSSIs and sites designated under the Birds and Habitats Directives.	Consideration of impacts on species and habitats including those which are features of MPAs are presented in **Section 9.8**.
East Inshore and East Offshore Marine Plans (Ref 9-16)	
The East Inshore and East Offshore Marine Plans, which are collectively referred to as 'the East Marine Plans', were formally adopted on 2 April 2014. There are five policies within the East Marine Plans specifically related to nature conservation and marine ecology.	Provides general guidance. See considerations of specific policies below.
Policy ECO1 - Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) **should** be addressed in decision-making and plan implementation:	Information on the cumulative and in-combination effects assessment for the Project are included in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** of this ES.
Policy BIO1 - Appropriate weight **should** be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence on those habitats and species that are protected or of conservation	Consideration of impacts to habitats and species that are protected or of conservation concern is presented in **Section 9.8**.

Legislation / Policy / Guidance	Consideration within the ES
concern in the East Marine Plans and adjacent areas (marine, terrestrial).	
Policy BIO2 - Where appropriate, proposals for development **should** incorporate features that enhance biodiversity and geological interests.	Consideration of design, mitigation and enhancement measures is outlined in **Section 9.7 and Section 9.9**.
Policy MPA1 - Any impacts on the overall MPA network must be taken into account in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network:	Consideration of impacts habitats and species that are features of MPAs is presented in **Section 9.8**. A **Shadow HRA** has been produced **[TR030008/APP/7.6]**. MCZs are considered in **Section 9.8**.
Policy FISH2 - Proposals **should** demonstrate, in order of preference: a) that they will not have an adverse impact upon spawning and nursery areas and any associated habitat, b) how, if there are adverse impacts upon the spawning and nursery areas and any associated habitat, they will minimise them, c) how, if the adverse impacts cannot be minimised they will be mitigated, and d) the case for proceeding with their proposals if it is not possible to minimise or mitigate the adverse impacts	**Section 9.6** provides background information on fish spawning and nursery areas in the vicinity of the Project. A preliminary consideration of impacts on fish is provided in **Section 9.8**.
North East Lincolnshire Local Plan 2013 to 2032 (Ref 9-17)	
The North-East Lincolnshire Local Plan was adopted in 2018 and covers the period 2013 to 2032. Policy 7 of the plan highlights that for operational port areas “proposals for port related use will be supported and, where appropriate, approved by the Council if the submitted scheme accords with the development plan as a whole and subject to the ability to satisfy the requirements of the Habitats Regulations.” In addition, Policy 41 of the plan states that: “*The Council will have regard to biodiversity and geodiversity when considering development proposals, seeking specifically to:* *A. establish and secure appropriate management of long-term mitigation areas within the Estuary Employment Zone, managed specifically to protect the integrity of the internationally important biodiversity sites (see Policy 9 ‘Habitat Mitigation - South Humber Bank’);* *B. designate Local Wildlife Sites (“LWS”s) and Local Geological Sites (LGSs) in recognition of particular wildlife and geological value;* *C. protect manage and enhance international, national and local sites of biological and geological*	Consideration of impacts on marine species and habitats and designated sites are presented in **Section 9.8**. A **Shadow HRA** has been produced **[TR030008/APP/7.6].** This policy is considered for terrestrial ecology in **Chapter 8: Terrestrial Ecology [TR030008/APP/6.2].**

Legislation / Policy / Guidance	Consideration within the ES
conservation importance, having regard to the hierarchy of designated sites, and the need for appropriate buffer zones; *D. localize the loss of biodiversity features, or where loss is unavoidable and justified ensure appropriate mitigation and compensation measures are provided;* *E. create opportunities to retain, protect, restore and enhance features of biodiversity value, including priority habitats and species; and,* *F. take opportunities to retain, protect and restore the connectivity between components of the Borough's ecological network.* Any development which would, either individually or cumulatively, result in significant harm to biodiversity which cannot be avoided, adequately mitigated or as a last resort compensated for, will be refused".	

9.4 Assessment Methodology

9.4.1 To facilitate the impact assessment process and ensure consistency in the approach to assessing a standard assessment methodology will be applied to determine the significance of effects within this chapter**.** This methodology has been developed from a range of sources, including relevant Environmental Impact Assessment ("EIA") Regulations, the EIA Directive (2014/52/EU), statutory and non-statutory guidance, consultations and professional project experience. The assessment also follows the principles of relevant guidance, including Institute of Environmental Management and Assessment ("IEMA") guidelines, and the latest Chartered Institute of Ecology and Environmental Management ("CIEEM") guidelines for ecological impact assessment in the UK and Ireland (which combine advice for terrestrial, freshwater and coastal environments) (Ref 9-2). The methodology adopted is considered to be 'best practice'.

9.4.2 The environmental issues are divided into distinct 'receiving environments' or 'receptors'. The effect of the proposed development on each of these has been assessed by describing in turn:

a. The baseline environmental conditions of each receiving environment.

b. The 'impact pathways' by which the receptors could be affected.

c. The significance of the effect occurring as a result of the impact.

d. The measures to mitigate for significant adverse effects where these are predicted.

9.4.3 In accordance with CIEEM (Ref 9-2), an impact is defined as an action resulting in changes to an ecological feature (e.g., construction activities resulting in the direct loss of benthic habitat) and an effect is the outcome to an ecological feature from an impact (e.g. the effects on fish from the loss of benthic habitat).

Magnitude of impacts

9.4.4 The first stage in the assessment process involves understanding the impact magnitude which is determined by predicting the scale of any potential change in baseline conditions.

9.4.5 Magnitude of change needs to be considered in spatial and temporal terms (including duration, frequency and seasonality), and against background environmental conditions in a study area. The assessment of magnitude should also be carried out taking account of any embedded and standard design mitigation.

9.4.6 The following criteria have been used to assess the magnitude of impact:

a. Negligible: Changes that are barely discernible from existing baseline conditions.

b. Small: Relatively localised changes that are often temporary in nature and/or a receptor has limited exposure to change.

c. Medium: Receptors are subject to changes that occur over a large spatial area, but the effects are considered temporary.

d. Large: Receptors are subject to changes over a large spatial area with effects that are considered permanent/long-term duration.

9.4.7 Once a magnitude has been assessed, this is then considered in terms of the probability of occurrence (i.e. likelihood that the impact will occur) to derive an overall level of exposure to change.

Sensitivity of receptors

9.4.8 Sensitivity can be described as the intolerance of a habitat, community or individual of a species to an environmental change and essentially considers the response characteristic of the feature. The sensitivity of a marine habitat or species is considered to be a product of the following (Ref 9-140):

a. The likelihood of damage (termed intolerance or resistance) due to a pressure. This could include behavioural effects, physiological damage or even mortality of individuals or populations.

b. The rate of (or time taken for) recovery (termed recoverability, or resilience) of marine species once the pressure has abated or been removed.

9.4.9 The following criteria have been used to assess sensitivity:

a. **Low**: Pressures in which the likelihood of damage to individuals or populations is low with recoverability expected to occur over short timescales.

b. **Moderate**: Pressures in which damage to individuals or populations could occur but recoverability is expected to occur over short to moderate timescales.

c. **High**: Pressures in which damage to individuals or populations is highly likely with either no recoverability or recoverability expected to occur over longer timescales.

9.4.10 **Table 9-3** summarises the sensitivity level that has been assigned to different receptors considered in this assessment based on consideration of the criteria highlighted above. Further rationale for the sensitivity levels that have been assigned are included for each pathway in the impact assessment.

Table 9-3: Assessed sensitivity of marine ecology receptors.

Receptor	Sensitivity
Benthic, habitats and species	The benthic habitats and species in the dredge footprint and disposal sites are considered to have a **high** sensitivity to habitat loss, a **low** sensitivity to habitat change (due to relatively high recoverability), a **low** to **moderate** sensitivity to non-native species introductions and a **low** sensitivity to water quality and underwater noise on the scale predicted.
Intertidal and coastal terrestrial habitats	The intertidal and coastal terrestrial habitats within the zone of influence are considered to have a **high** sensitivity to changes in air quality due to high background levels of some pollutants.
Fish	Fish species in the study area are considered to have a **low** sensitivity to marine habitat change on the scale predicted for the Project (due to the high mobility of the species). They are considered to have a **low to moderate sensitivity** to water quality and underwater noise (depending on the species and activity).
Marine mammals	Marine mammals are generally considered to have a **low** sensitivity to changes in water quality and marine habitat change / loss on the scale predicted for the Project (due to the high mobility of the species). The species in the study area are considered to have a **moderate** sensitivity to the anticipated level of underwater noise generated by the Project from marine piling and a low sensitivity to noise due to dredging activities.

Receptor importance

9.4.11 In considering the magnitude of impacts and sensitivity of the receptor, it is also necessary to identify whether an ecological feature is ‘important’. As such, where possible, habitats, species and their populations have been valued on the basis of a combination of their conservation status, rarity and ecological/socioeconomic value using contextual information - where it exists.

9.4.12 The CIEEM (Ref 9-2) guidelines recognise that determining ecological importance is a complex process, which is a matter of professional judgement guided by the importance and relevance of a number of factors. These include designation and legislative protection as well as biodiversity value and secondary / supporting value (e.g. where habitats may function as a buffer or resource associated with an adjacent designated area).

9.4.13 The importance of each ecological receptor has been determined, based on the following criteria:

a. **Low**: The receptor is neither protected nor designated and is considered to be of low to moderate biodiversity or supporting value.

b. **Moderate** Statutory protection/designation is afforded to a receptor, but it is considered to be of low to moderate biodiversity/supporting value or the receptor does not receive statutory protection but is considered to be of high biodiversity or supporting value.

c. **High**: Statutory protection/designation is afforded to a receptor and the receptor is considered to be of high biodiversity or supporting value.

9.4.14 The importance of a receptor has also been considered with regard to the marine geographic frame of reference defined below as recommended in the CIEEM (Ref 9-2) guidelines:

a. International and European

b. National

c. Regional (Humber Estuary)

d. Local (Port of Immingham area)

9.4.15 **Table 9-4** summarises the importance level that has been assigned to the different receptors that have, to date, been assessed based on the criteria highlighted above.

Table 9-4: Assessment of the importance of marine ecology receptors

Receptor	Importance
Benthic habitats and species	**Low to high** (local to international) importance: Intertidal habitats in the study area are considered to be of **high** importance due to their designated status (as a qualifying feature of the Humber Estuary SAC and Sites of Special Scientific Interest (SSSI), NERC listed habitat and as supporting habitat of the Humber Estuary SPA, as well as the functional importance they provide in terms of benthic prey resources for intertidal birds. The disposal sites identified for the disposal of the dredged arisings are considered to be of **moderate** importance due to their typically impoverished nature and low ecological value albeit characteristic of the *Sandbanks which are slightly covered by sea water all the time* qualifying feature of the Humber Estuary SAC. The importance of other subtidal habitats in the vicinity of the proposed development is also considered to be **moderate.** This is because subtidal species in the area are considered to be commonly occurring and of low conservation concern with the habitats not characteristic of any of the qualifying

Receptor	Importance
	features of overlapping designated sites although it is noted that subtidal habitats form a component of the 'Estuaries' feature of the SAC.
Intertidal and coastal terrestrial habitats	Intertidal and coastal terrestrial habitats in the study area are considered to be of **high** importance due to their designated status (as a qualifying feature of the Humber Estuary SAC, SSSI, NERC listed habitat and as supporting habitat of the Humber Estuary SPA.
Fish	**Low to high** (local to international) importance: Some species are commonly occurring and not protected - these are considered to be of low importance such as sand gobies *Pomatoschistus minutus* or mullet species. Other species which are commercially important species (e.g., whiting *Merlangius merlangus*, Dover sole *Solea solea* and plaice *Pleuronectes platessa*) are considered to be of **moderate** importance. Species such as diadromous migratory species (European eel *Anguilla anguilla*, Atlantic salmon *Salmo salar*, sea trout *Salmo trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, twaite shad *Alosa fallax*, allis shad *Alosa alosa*, European smelt *Osmerus eperlanus*) are considered to be of **high** importance.
Marine mammals	**High** (international) importance: All species are of conservation interest and protected.

Significance criteria

9.4.16 Determination of the significance of the predicted ecological effects is based on professional judgement having regard to the positive (beneficial) or negative (adverse) nature of a potential impact.

9.4.17 In summary, to assess the significance of effects, the magnitude of the impact pathway and the probability of it occurring is evaluated to understand the exposure to change. This is then assessed against the sensitivity of a receptor/ feature to understand its vulnerability. Finally, this is considered in the context of the importance of a receptor/feature to generate a level of significance for effects resulting from each impact pathway.

9.4.18 The CIEEM (Ref 9-2) guidelines state that an effect should be determined as being significant when it "*either supports or undermines biodiversity conservation objectives for important ecological* features". It relates to the weight that should be afforded to effects when decisions are made, and to the consequences, in terms of legislation, policy and/or development control. A significant adverse effect on a feature of importance (as defined in **Table 9-4**) would, therefore, be likely to generate the need for development control mechanisms, such as DCO Protective Provisions or Requirements.

9.4.19 Whilst this assessment adopts an Ecological Impact Assessment ("EcIA") approach and, therefore, expresses the significance of ecological effects with reference to a geographic frame of reference (as advocated in the CIEEM Guidelines), significance is also expressed using a generic EIA significance criteria. The generic criteria used throughout this report is based on an expression of severity, to describe the significance of environmental impacts. For ease of reference, **Table 9-5** provides a means of relating the two approaches

and is provided in order to allow the EcIA to be integrated into the wider EIA framework without compromising the CIEEM best practice approach.

9.4.20 To ensure transparency in the impact assessment, it is important to make clear the evidence-based or value-based judgments used at each stage of the assessment and how they have been attributed to a level of significance. This is presented in the impact assessment for each impact pathway.

9.4.21 Following the significance assessment, a confidence assessment was undertaken which recognises the degree of interpretation and professional judgement applied. This is presented in the summary table contained within the conclusions section of this chapter (**Section 9.11**). Confidence was assessed on a scale incorporating three values: low, medium and high.

9.4.22 As shown in **Table 9-5**, effects that are identified as being moderate or major adverse/beneficial are classified as significant effects and those as minor or insignificant as not significant.

Table 9-5: Significance Criteria

Significance Level		Criteria	CIEEM Geographical Criteria
Significant	Major	These effects are likely to be important considerations at a local or district scale but, if adverse, are potential concerns to the project and may become key factors in the decision-making process.	Ecological impacts assessed as being significant at the regional scale and that have triggered a response in development control terms are considered to represent impacts that overall, within this assessment, are of major significance.
	Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.	Ecological impacts assessed as being significant at the county/metropolitan scale, and that have triggered a response in development control terms, will be considered to represent impacts that overall, within this assessment, are of moderate significance.
Not significant	Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.	Ecological impacts assessed as being significant at the local scale, and that have triggered a response in development control terms, will be considered to represent impacts that overall, within this assessment, are of minor significance.

Significance Level		Criteria	CIEEM Geographical Criteria
	Insignificant	No effect or an effect which is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error.	Ecological impacts that have been assessed as not being significant at any geographic level.

Impact assessment guidance tables

9.4.23 The matrices in **Table 9-6** to **Table 9-8** have been used to help assess significance.

9.4.24 **Table 9-6** has been used as a means of generating an estimate of exposure to change. Once a magnitude has been assessed, this has been combined with the probability of occurrence to arrive at an exposure score which can then be used for the next step of the assessment, which is detailed in **Table 9-7**. For example, an impact pathway with a medium magnitude of change and a high probability of occurrence would result in a medium exposure to change.

Table 9-6: Exposure to change, combining magnitude and probability of change

Probability of Occurrence	Magnitude of Change			
	Large	Medium	Small	Negligible
High	High	Medium	Low	Negligible
Medium	Medium	Medium/Low	Low /Negligible	Negligible
Low	Low	Low /Negligible	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

9.4.25 **Table 9-7** has then been used to score the vulnerability of the features/receptors of interest based on the sensitivity of those features and their exposure to a given change.

Table 9-7: Estimation of vulnerability based on sensitivity and exposure to change

Sensitivity of Feature (Table 9-3)	Exposure to change (Table 9-6)			
	High	Medium	Low	Negligible
High	High	High	Moderate	None
Moderate	High	Moderate	Low	None
Low	Moderate	Low	Low	None

Sensitivity of Feature (Table 9-3)	Exposure to change (Table 9-6)			
	High	Medium	Low	Negligible
None	None	None	None	None

9.4.26 The vulnerability has then been combined with the importance of the feature of interest using **Table 9-8** to generate an initial level of significance. For example, if a high vulnerability is assessed against a feature of low importance, the level of significance of the effect is assessed as minor.

Table 9-8: Estimation of significance based on vulnerability and importance

Importance of Receptor (Table 9-4)	Vulnerability of Feature to Impact (Table 9-7)			
	High	Moderate	Low	None
High	Major	Moderate	Minor	Insignificant
Moderate	Moderate	Moderate/Minor	Minor/Insignificant	Insignificant
Low	Minor	Minor/Insignificant	Insignificant	Insignificant
None	Insignificant	Insignificant	Insignificant	Insignificant

Significance criteria impact management (mitigation)

9.4.27 Impacts that are found to be significant in the process, (i.e., **moderate** and/or **major adverse**) may require mitigation measures to reduce residual impacts, as far as possible, to environmentally acceptable levels. Within the assessment procedure the use of mitigation measures will alter the risk of exposure and, hence, will require significance to be re-assessed and thus the residual impact (i.e., with mitigation) identified.

9.4.28 Mitigation measures considered throughout the EIA process can take three forms (as summarised in (see **Chapter 5: EIA Approach [TR030008/APP/6.2]**)) (Ref 9-141):

a. *Embedded mitigation measures:* modifications to the location, design or operation of a development that are an inherent part of the Project and do not require additional action to be taken.

b. *Standard mitigation measures:* measures comprising management activities and techniques, which would be implemented during construction of the Project to limit impacts through adherence to good site practice and achieving legal compliance. These measures for the construction phase are set out in the Outline Construction Environmental Management Plan ("CEMP") **[TR030008/APP/6.5]**.

c. *Additional mitigation measures:* these comprise measures over and above any embedded and standard mitigation measures, for which the EIA has

identified a requirement to further reduce likely significant environmental effects.

9.4.29 In addition, it is appropriate to adopt a mitigation hierarchy which, from the CIEEM (Ref 9-2) guidance on ecological impact assessment specifically, can be summarised as follows:

a. In the first instance, seek to adopt options that avoid harm.

b. Identify ways to minimise adverse effects that cannot be completely avoided through mitigation.

c. Provide compensation where there are significant residual adverse effects despite the mitigation proposed.

d. Provide net benefits (for biodiversity) above requirements for avoidance, mitigation or compensation.

9.4.30 In some instances, a decision may need to be taken despite residual uncertainty about the effects. In such cases, adaptive management, linked to a bespoke monitoring programme, is a well-established and recommended way of ensuring that any negative impacts or effects are addressed in the course of the development and during the subsequent operational phase.

Limitations and Assumptions

9.4.31 This assessment has been undertaken based on the following assumptions:

a. The Project design and project methodology, as detailed in **Chapter 2: The Project** and **Chapter 3: Need and Alternatives** of the ES **[TR030008/APP/6.2]**.

b. The baseline (**Section 9.6**) used to inform the fish assessment is based on fish survey data from nearby to the Project. While these surveys do not overlap specifically with the Project, they are considered broadly representative of the fish assemblage that could be present within the dredge footprint and surrounding local area. This is because the surveys have used a variety of techniques to target different habitats within both the intertidal and subtidal. The Transitional and Coastal Waters ("TrAC") surveys are also relatively contemporary and cover a range of seasons.

c. The underwater noise assessment assumes that up to three tubular piles to be installed each day using up to two marine piling rigs pile driving concurrently as a worst case;

d. The underwater noise assessment assumes that the dredging and vessel activity will take place continuously (24/7) during construction and as such, provides a precautionary assessment (noting that capital dredging is programmed for 12 days).

e. Future maintenance dredging within the new berth pocket is expected to be very limited (if required at all) as summarised in the physical processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2])**.

f. The underwater noise assessment assumes that marine mammals will evade the noise source.

9.4.32 Whilst these are assumptions, the assessment within this ES has been undertaken considering the anticipated worst-case scenario in respect of marine ecology receptors at the dredge, marine piling and disposal locations.

9.5 Study Area

9.5.1 The study area for this assessment is the area over which potential direct and indirect effects of the Project are predicted to occur during the construction and operational periods. The direct effects on nature conservation and marine ecology receptors are those that occur within the footprint of the Project, such as the direct disturbance to benthic habitats and associated species as a result of construction. Indirect effects are those that may arise outside this footprint, such as the potential underwater noise effects on fish during construction.

9.5.2 The study area for the nature conservation and marine ecology topic is focused on the Port of Immingham and proposed disposal sites with data for the wider Humber Estuary region presented where relevant to provide contextual information and to ensure the area of potential effects (e.g., noise disturbance) are fully considered.

9.6 Baseline Conditions

Current Baseline

Data and information sources

9.6.1 Current baseline conditions have been determined by a desk-based review of available information. A project-specific subtidal benthic survey has also been undertaken to characterise seabed habitats and species within and near to the proposed dredge footprint.

9.6.2 The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the Project include:

Nature conservation sites

a. Natura 2000 standard data forms or information sheets for each designation: Information on the species and habitats listed in the original citations (Ref 9-38; Ref 9-39; Ref 9-40; Ref 9-41).

b. Multi-Agency Geographic Information for the Countryside (“MAGIC”) Interactive Map (Ref 9-19): Information on the boundaries of designated sites.

c. Natural England Conservation Advice for Marine Protected Areas: Humber Estuary SAC (Ref 9-20) and Humber Estuary SPA (Ref 9-21).

Benthic habitats and species

d. Recent Port of Immingham Benthic Surveys between the Immingham Oil Terminal and Eastern Jetty. This included ten intertidal stations sampled in September 2021 using a 0.01m² hand-held core and ten subtidal stations that were sampled in September 2021 using a 0.1m² Day Grab. In addition, six stations were sampled at dredge disposal sites HU060 and HU056 in September 2021 using a 0.1m² Day Grab (four within each of the disposal sites and two nearby to each of the disposal sites).

e. Able Marine Energy Park Benthic Surveys: The results of intertidal benthic surveys (undertaken in 2015 and 2016) using a 0.01m² core sample and a subtidal survey in 2016 using a 0.1m² Day Grab in the North Killingholme area (Ref 9-22).

f. Humber Estuary SAC Intertidal Sediment Survey: Ecological survey work undertaken in 2014 to monitor and assess the intertidal mudflat and sandflat communities of the Humber Estuary (Ref 9-44).

g. Immingham Outer Harbour Benthic Surveys: Intertidal sampling at 14 stations (using a Day Grab (0.06m²) or Van Veen Grab (0.03m²) and subtidal sampling at 17 stations in the Port of Immingham area in 2009 (Ref 9-23).

h. South Humber Channel Marine Studies: Benthic sampling in the intertidal (using a 0.01m² core from 36 stations) and subtidal (0.1m² Hamon grab from 30 stations) between the Humber Sea Terminal and Immingham Port undertaken in 2010 (Ref 9-24).

i. HU056 Disposal Site Monitoring: Benthic invertebrate samples collected at five sites within the disposal sites and at six locations nearby (triplicate samples at all locations) in 2017 (Ref 9-25).

j. Clay Huts Disposal Site Benthic Monitoring: Benthic invertebrate samples collected from four stations in 2008 from within and near to the Clay Huts disposal sites (Ref 9-23).

Fish

k. South Humber Channel Marine Studies: Fish surveys in the intertidal (four double-ended fyke nets) and subtidal (eight beam trawls) between the Humber Sea Terminal and Port of Immingham undertaken in 2010 (Ref 9-24). These sites are located approximately 3 to 4km from the Project.

l. Review of fish population data in the Humber Estuary: A review of available data to describe the fish populations in the Humber Estuary (Ref 9-57).

m. The Humber Regional Environmental Characterisation (“REC”): Fish ecology information provided in the Marine Aggregate Levy Sustainability Fund (Ref 9-26).

n. Environment Agency TraC Fish Monitoring: The results of the most recently available WFD fish monitoring for the nearest sites to the Project (seine netting/bream trawls at Foulholme Sands and otter trawls at Burcom). The Foulholme Sands surveys were undertaken twice a year in the spring and autumn with the Burcom surveys annually in the early winter. These sites are located approximately 3-5km from the Project with data available up to 2017 for Foulholme Sands and 2019 for Burcom (Ref 9-27).

o. Cefas Spawning and Nursery Grounds of Selected Fish Species in UK waters: Distribution maps of the main spawning and nursery grounds for 14 commercially important species (cod, haddock, whiting, saithe, Norway pout, blue whiting, mackerel, herring, sprat, sandeels, plaice, lemon sole, sole and Norway lobster) (Ref 9-28).

p. Fish Atlas of the Celtic Sea, North Sea, and Baltic Sea: The study provides an overview of information collected from internationally coordinated and national surveys and presents data and information on the recent distribution and biology of demersal and small pelagic fish in these ecoregions (Ref 9-29).

Marine mammals

q. Donna Nook Seal Counts: The latest pup counts available from the Lincolnshire Wildlife Trust for winter 2021/22 and 2020/21.

r. Sea Watch Foundation Review of Marine Mammals in the Humber Estuary Region: Information on cetacean status and distribution in the area derived from survey data and the national sightings database maintained by the Sea Watch Foundation with sightings data from 2000 onwards analysed (Ref 9-30).

s. Records of marine mammal sightings from the Lincolnshire Environmental Records Centre (Ref 9-31) and National Biodiversity Network (Ref 9-32).

t. Distribution maps of cetacean and seabird populations in the North-East Atlantic: Distribution maps of cetaceans and seabirds based on survey data in the North-East Atlantic between 1980 and 2018 collated and standardised (Ref 9-33).

u. At-sea Distribution Data for Grey and Harbour Seals: The latest habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles (including the Humber Estuary region) estimated using data from animal-borne telemetry tags by the Sea Mammal Research Unit (“SMRU”) (Ref 9-34).

v. Donna Nook Telemetry Data; The results of the tagging of 11 grey seals from the Donna Nook colony to understand the movements of grey seals in the region (Ref 9-35).

w. Special Committee on Seals (“SCOS”) Annual Report: Information on the status of seals around the UK coast is reported annually by the SMRU advised SCOS (Ref 9-36).

x. The Identification of Discrete and Persistent Areas of Relatively High Harbour Porpoise Density in the Wider UK Marine Area: The report presents the results of 18 years of survey data in the Joint Cetacean Protocol ("JCP"), undertaken to inform the identification of discrete and persistent areas of relatively high harbour porpoise density in the UK marine area (Ref 9-37).

y. Small Cetaceans in European Atlantic Waters and the North Sea ("SCANS") III Data: Cetacean surveys to estimate the abundance of cetacean species in shelf and oceanic waters of the European Atlantic undertaken in 2016. Teams of observers searched along 60,000 km of transect line, recording thousands of groups of cetaceans from 19 different species. The survey (SCANS-III) is the third in a series that began in 1994 (SCANS) and continued in 2005 (SCANS-II) (Ref 9-37).

z. Inter-Agency Marine Mammal Working Group ("IAMMWG") Management Units Abundance Estimates: In 2015, the IAMMWG defined Management Units ("MUs") for the seven most common cetacean species found in UK waters: harbour porpoise, bottlenose dolphin, short-beaked common dolphin, white-beaked dolphin, Atlantic white-sided dolphin, Risso's dolphin and minke whale. Updated abundance estimates for these species and their MUs have been obtained from (SCANS)-III' (Ref 9-135).

9.6.3 Site specific surveys that have been undertaken to underpin the assessments include:

a. **Subtidal benthic sampling:** Eight subtidal stations were sampled in July 2022 (using a 0.1 m² Day Grab) within and near to the Project footprint. The location of the survey stations is shown in **Figure 9.1 [TR030008/APP/6.3].** All the samples collected were analysed for macrofaunal analysis (faunal composition, abundance and biomass), Particle Size Analysis ("PSA") and Total Organic Carbon ("TOC"). The methods and results of these surveys are included in **Appendix 9.A [TR030008/APP/6.4]** and summarised in **Section 9.6** of this chapter.

Nature conservation sites and protected species

Designated sites

9.6.4 The Project falls within the boundaries of the Humber Estuary SAC, SPA and Ramsar site (collectively forming the Humber European Marine Site ("EMS"); **Figure 9.2 [TR030008/APP/6.3]**). For the Humber Estuary SAC, the primary reason for designation is the presence of two broad scale habitats, 1130 Estuaries and 1140 Mudflats and sandflats not covered by seawater at low tide (Ref 9-38). These broad scale habitats support other more specific habitats which are qualifying features but not a primary reason for designation. These are:

a. 1110 Sandbanks which are slightly covered by sea water all the time.

b. 1150 Coastal lagoons (identified as a priority feature).

c. 1310 *Salicornia* and other annuals colonizing mud and sand.

d. 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae).

e. 2110 Embryonic shifting dunes.

f. 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes').

g. 2130 Fixed coastal dunes with herbaceous vegetation ('grey dunes') (identified as a priority feature).

h. 2160 Dunes with *Hippopha rhamnoides*.

9.6.5 Alongside the habitats for which the SAC is designated, there are also three mobile species listed on Annex II of the EU Habitats Directive (92/43/EEC) (the Natural Habitats and Wild Fauna and Flora Directive) included in the designation (Ref 9-38), namely:

a. 1095 Sea lamprey (*Petromyzon marinus)*.

b. 1099 River lamprey (*Lampetra fluviatilis)*.

c. 1364 Grey seal (*Halichoerus grypus*).

9.6.6 Qualifying features of the Humber Estuary SPA and Humber Estuary Ramsar site are shown in **Table 9-9** and **Table 9-10** respectively.

Table 9-9: Qualifying features of the Humber Estuary SPA (Ref 9-39)

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Bittern *Botaurus stellaris*	2 calling males (10.5 % of the GB population)
Marsh Harrier *Circus aeruginosus*	10 breeding females (6.3 % of the GB population)
Avocet *Recurvirostra avosetta*	64 pairs (8.6 % of the GB population)
Little Tern *Sternula albifrons*	51 pairs (2.1 % of the GB population)
Wintering Species Population	
Bittern	4 (4.0 % of the GB population)
Hen harrier *Circus cyaneus*	8 (1.1 % of the GB population)
Bar-tailed Godwit *Limosa lapponica*	2,752 (4.4 % of the GB population)
Golden Plover *Pluvialis apricaria*	30,709 (12.3 % of the GB population)
Avocet *Recurvirostra avosetta*	54 (1.7 % of the GB population)
On passage Species population	
Ruff *Calidris pugnax*	128 (1.4 % of the GB population)

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Migratory Species	
Wintering Species Population	
Teal† *Anas crecca*	2,322 (<1 % of the population)
Wigeon† *Mareca penelope*	5,044 (<1 % of the population)
Mallard† *Anas platyrhynchos*	2,456 (<1 % of the population)
Turnstone† *Arenaria interpres*	629 (<1 % of the population)
Common Pochard† *Aythya ferina*	719 (<1 % of the population)
Greater Scaup† *Aythya marila*	127 (<1 % of the population)
Brent Goose† *Branta bernicla*	2,098 (<1 % of the population)
Goldeneye† *Bucephala clangula*	467 (<1 % of the population)
Sanderling† *Calidris alba*	486 (<1 % of the population)
Dunlin *Calidris alpina*	22,222 (1.7 % of the Northern Siberia/Europe/Western Africa population)
Red Knot *Calidris canutus*	28,165 (6.3 % of the North-eastern Canada/Greenland/Iceland/North-western Europe population)
Ringed Plover† *Charadrius hiaticula*	403 (<1 % of the population)
Oystercatcher† *Haematopus ostralegus*	3503 (<1 % of the population)
Black-tailed Godwit *Limosa*	1,113 (3.2 % of the Icelandic Breeding population)
Curlew† *Numenius arquata*	3,253 (<1 % of the population)
Grey Plover† *Pluvialis squatarola*	1,704 (<1 % of the population)
Shelduck *Tadorna tadorna*	4,464 (1.5 % of the North-western Europe population)
Redshank *Tringa totanus*	4,632 (3.6 % of the Eastern Atlantic Wintering population)
Northern Lapwing† *Vanellus vanellus*	22,765 (<1 % of population)
On passage Species Population	
Sanderling†	818 (<1 % of the population)
Dunlin	20,269 (1.5 % of the Northern Siberia/Europe/Western Africa population)

Internationally Important Populations	
Red Knot	18,500 (4.1 % of the North-eastern Canada/Greenland/Iceland/North-western Europe population)
Ringed Plover†	1,766 (<1 % of the population)
Black-tailed Godwit	915 (2.6 % of the Icelandic Breeding population)
Whimbrel† *Numenius phaeopus*	113 (<1 % of the population
Grey Plover†	1,590 (<1 % of the population)
Greenshank† *Tringa nebularia*	77 (<1 % of the population)
Redshank	7,462 (5.7 % of the Eastern Atlantic Wintering population)
Internationally Important Assemblage of Waterfowl	
Waterfowl assemblage	153,934 waterfowl
†Species with this symbol do not represent a population that is > 1 % of the international threshold but are included in the waterfowl assemblage.	

Table 9-10: Qualifying marine features of the Humber Estuary Ramsar Site (Ref 9-40)

Ramsar Criterion	
Criterion 1 – natural wetland habitats that are of international importance	
The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	
Criterion 3 – supports populations of plants and/or animal species of international importance	
The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	
Criterion 5 – Bird Assemblages of International Importance	
Wintering waterfowl	153,934 waterfowl (5-year peak mean 1998/99-2002/3)
Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance	
Species	Spring/Autumn Population (5-year peak mean 1996-2000)

Ramsar Criterion	
Golden Plover	17,996 (2.2 % of the Iceland & Faroes/East Atlantic population)
Red Knot	18,500 (4.1 % of the West & Southern African wintering population)
Dunlin	20,269 (1.5 % of the West Siberia/West Europe population)
Black-tailed Godwit	915 (2.6 % of the Iceland/West Europe population)
Redshank	7,462 (5.7 % of the population)
Species	Wintering Population (5-year peak mean 1996/7-2000/1)
Shelduck	4,464 (1.5 % of the North-western Europe Population)
Golden Plover	30,709 (3.8 % of the Iceland & Faroes/East Atlantic population)
Red Knot	28,165 (4.1 % of the West & Southern African wintering population)
Dunlin	22,222 (1.7 % of the West Siberia/West Europe population)
Black-tailed Godwit	1,113 (3.2 % of the Iceland/West Europe population)
Bar-tailed Godwit	2,752 (2.3 % of the West Paleartic population)
Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path	
The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	

9.6.7 The Greater Wash SPA is designated for a range of seabird and diving bird species and is located approximately 20km from the Project. Qualifying features of this site is shown in **Table 9-11**.

Table 9-11: Qualifying marine features of the Greater Wash SPA (Ref 9-41)

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Little Tern *Sternula albifrons*	798 pairs (42% of GB breeding population)
Common Tern *Sterna hirundo*	510 pairs (5.1% of GB breeding population)
Sandwich Tern *Sterna sandvicensis*	852 pairs (35% of GB breeding population)
Wintering Species Population	
Little Gull *Hydrocoloeus minutus*	1,255 (no current GB population estimate)
Red-throated Diver *Gavia stellata*	1,407 (8.3% of GB non-breeding population)
Internationally Important Populations of Regularly Occurring Migratory Species	
Common Scoter *Melanitta nigra*	3,449 (0.6% of biogeographic population)

9.6.8 The Humber Estuary Site of Special Scientific Interest ("SSSI") overlaps part of the Project site. This is designated for its nationally important habitat assemblage (intertidal mudflats and sandflats, and coastal saltmarsh) geological interest, importance to breeding, wintering and passage birds, breeding grey seal and the presence of river and sea lamprey.

9.6.9 North Killingholme Haven Pits SSSI is located approximately 5km away from the Project. This site comprises saline lagoon habitats and supports important populations of waders including Black-tailed Godwits and Redshank. The Lagoons SSSI is located approximately 20km from the Project and supports a variety of coastal habitats (such as saline lagoons and sand dunes) as well as a population of breeding Little Terns.

9.6.10 The Holderness Inshore MCZ is the nearest MCZ to the Project (located approximately 20km away). The site is designated for intertidal sand and muddy sand as well as a variety of subtidal rock and sedimentary habitats.

9.6.11 The nearest Local Nature Reserve ("LNR") is Cleethorpes Sands LNR (located approximately 13km south east of the Project) which supports a variety of intertidal and coastal habitats.

Protected species

9.6.12 The Wildlife and Countryside Act 1981 (as amended) ("WCA") protects various animals, plants, habitats in the UK. Relevant protected WCA species recorded in the Humber Estuary region include:

a. The tentacled lagoon worm *Alkmaria romijni*.

b. The lagoon sand shrimp *Gammarus insensibilis*.

c. Twaite shad *Alosa fallax* and allis shad *Alosa alosa*.

d. Cetacean (whale and dolphin) species.

e. All bird species.

9.6.13 Marine species are also protected from being killed, injured or disturbed both inside and outside designated sites under the provisions of the Habitats Directive. Of relevance to the Humber Estuary are:

a. Common seal *Phoca vitulina* and grey seal *Halichoerus grypus* (listed in Annex II and V).

b. Bottlenose dolphin *Tursiops truncatus* and harbour porpoise *Phocoena phocoena* (listed in Annex II and IV).

c. Sea lamprey *Petromyzon marinus* (listed in Annex II) and river lamprey (listed in Annex II and V).

d. Twaite shad *A. fallax* and allis shad *A. alosa* (listed in Annex II and V).

e. Atlantic salmon *Salmo salar* (listed in Annex II and V).

9.6.14 Seals are also protected under the Conservation of Seals Act 1970.

9.6.15 In addition, some marine fauna and habitats are listed as priority species and habitats of principle importance in England, as required under Section 41 of the NERC Act 2006. Species of principal importance which are of relevance to the Humber Estuary include various species of waterbird, commercial fish (such as cod *Gadus morhua* and herring *Clupea harengus*), migratory fish (such as lampreys, European smelt *Osmerus eperlanus*, Atlantic salmon and European eel *Anguilla anguilla*).

9.6.16 Habitats of principle importance which are of relevance to the Humber Estuary include intertidal mudflats, coastal saltmarsh, saline lagoons and sand dunes. Based on the current geographic extent and location of habitats of principal importance under Section 41 of the NERC Act 2006 that are publicly available on the MAGIC website (Ref 9-19), the proximity of these coastal and intertidal habitats to the Project are described below:

a. Mudflats: The intertidal habitat directly overlaps the footprint of the Project.

b. Coastal saltmarsh: The nearest saltmarsh habitat is located over 3km to the northwest of the Project.

c. Coastal sand dunes: The nearest coastal sand dunes within the Humber SAC are located more than 12km southwest of the Project at Cleethorpes.

d. Saline lagoons: The nearest coastal lagoon habitat within the Humber Estuary is located approximately 5km from the Project at Killingholme.

9.6.17 European eels are also afforded protection as part of the Eels (England and Wales) Regulations 2009 (Ref 9-13). The regulations which apply to all freshwater and estuarine waters of England and Wales give powers to statutory bodies to implement measures for the recovery of European eel stocks including improving access, habitat quality and easing fishing pressure.

Benthic habitats and species

Humber Estuary overview

9.6.18 The Humber Estuary supports a wide variety of marine habitats including intertidal mudflats and sandflats, intertidal seagrass beds, coastal lagoons, saltmarsh, reedbeds, subtidal sandbanks and mixed sediment habitats (Ref 9-42; Ref 9-43; Ref 9-44).

9.6.19 The intertidal area of the Humber Estuary is extensive, covering approximately 10,000 ha, of which more than 90 % is mudflat and sandflat (Ref 9-45). The largest areas of mudflat occur in the outer Humber Estuary at Spurn Bight and Pyewipe, at Foul Holme and Skitter Sand in the mid Humber Estuary and across most of the Estuary width in the inner estuary above the Humber Bridge. This habitat changes from moderately exposed sandy shores at the mouth of the Humber Estuary to sheltered muddy shores within the main body of the Estuary and up into the tidal rivers. The mid and upper Humber Estuary is characterised by fringing reedbeds *Phragmites australis* on the upper shore while saltmarshes are present along the north bank and on the Lincolnshire coast east of Cleethorpes (Ref 9-45; Ref 9-20; Ref 9-21; Ref 9-44).

9.6.20 The subtidal area of the Humber Estuary is approximately 16,800 ha in extent (Ref 9-45). The subtidal environment of the Humber Estuary is highly dynamic and varies according to the composition of the bottom sediments, salinity, sediment load and turbidity and dissolved oxygen. Many of these factors vary with the season or state of the tide. Subtidal sand (including muddy sand) is the predominant subtidal sediment type in the Humber Estuary. The high mobility of sediments and high turbidity means that this habitat is typically relatively impoverished with a limited fauna characterised by very low densities of opportunistic species and species adapted to these conditions (Ref 9-20; Ref 9-21; Ref 9-45).

9.6.21 Invasive marine species known to occur in the Humber Estuary region include slipper limpet *Crepidula fornicata*, Chinese mitten crab *Eriocheir sinensis*, Pacific oyster *Magallana gigas* and acorn barnacle *Austrominius modestus* (Ref 9-43; Ref 9-24; **Appendix 9.A [TR030008/APP/6.4]**).

Intertidal habitats and species in the Port of Immingham area

9.6.22 Intertidal benthic surveys undertaken in the Port of Immingham area in 2021 recorded sandy mud habitat with the number of taxa found in the samples ranging from four to 15. The number of individuals was also highly variable and ranged from 1,100 organisms per m² to 40,600 organisms per m². The samples were predominantly characterised by nematodes, the oligochaetes *Tubificoides benedii* and Enchytraeidae spp., the mud shrimp *Corophium volutator*, the mudsnail *Peringia ulvae*, Baltic tellin *Limecola balthica* as well as the polychaetes *Hediste diversicolor* and *Pygospio elegans* recorded in the samples. These species dominated the assemblage and contributed almost entirely to the total abundances of organisms recorded at most of the sites surveyed.

9.6.23 The assemblage recorded was considered typical of the community recorded on mudflats in the nearby area (Ref 9-23; Ref 9-24; Ref 9-22). For example, intertidal surveys at North Killingholme (located approximately 3km from the Project) in 2015 and 2016 also recorded a benthic assemblage characterised by species such as *Corophium volutator, Tubificoides benedii, Pygospio elegans, Hediste diversicolor, Limicola balthica* and nematodes with a broadly similar total number of individuals in the samples (up to around 50,000 organisms per m²) (Ref 9-22).

9.6.24 Many of the species recorded in the samples are considered prey species for coastal waterbirds such as polychaetes, Baltic tellin *Limecola balthica*, mudsnail *Peringia* spp. and mudshrimp *Corophium* spp. (Ref 9-55; Ref 9-56).

Project specific subtidal benthic surveys

9.6.25 In order to characterise the subtidal benthic communities present in the vicinity of the Project, subtidal sampling was undertaken in July 2022.

9.6.26 At each station, a sample was analysed for macrofaunal analysis (faunal composition, abundance and biomass), PSA and TOC.

9.6.27 The results of these project specific benthic surveys are summarised below in **Table 9-12** with the methods and results described in more detail in **Appendix 9.A [TR030008/APP/6.4]**.

9.6.28 The sediment from samples collected from the area consisted of mud and sandy mud. The TOC in the samples ranged between approximately 3 % and 6 %.

9.6.29 The samples collected were highly impoverished with the number of taxa found in the samples ranging from one (Station 3) to eight (Station 1), and the number of individuals from 10 organisms per m² (Station 3) to 190 organisms per m² (Station 1). The range in total species biomass in the samples was between <1 and 1.8 grams per m².

9.6.30 The faunal samples were characterised by low numbers of species (occurring in low abundances) including polychaetes (such *Nephtys* spp, *Streblospio shrubsolii* and *Scoloplos armiger*), nematodes, oligochaetes *Tubificoides* spp and crustacean *Diastylis rathkei*. All the species recorded from the samples in this area were considered commonly occurring in the region and not protected.

9.6.31 The faunal assemblage recorded is considered characteristic of subtidal habitats in this section of the Humber Estuary. For example, subtidal benthic surveys undertaken in the Immingham area in 2009, 2010, 2016 and 2021 predominantly recorded mud or muddy sand habitat which was generally impoverished (with a low number of taxa occurring at the majority of sites). The most commonly recorded infaunal species (generally recorded in low abundances) were the polychaetes *Capitella capitata*, *Streblospio shrubsolii, ,Pygospio elegans, Polydora cornuta*, oligochaetes *Tubificoides* spp., mud shrimp *Corophium volutator*, and nematodes (Ref 9-23; Ref 9-24; Ref 9-22).

Subtidal habitats and species at the disposal site

9.6.32 Dredge material will be deposited at either the Clay Huts disposal site (HU060) or Holme Channel disposal site (HU056).

9.6.33 Benthic surveys undertaken in 2021 within and near to Clay Huts disposal site (HU060) recorded predominantly sand habitat with the samples characterised by a wide range of species but typically in low abundances including nematodes, barnacle *Amphibalanus improvises*, polychaetes (such as *Pygospio elegans* and *Arenicola* spp.) and the amphipod *Corophium volutator*. Benthic sampling at the Holme Channel disposal site (HU056) recorded sand, gravelly sand and sandy gravel habitat with a highly impoverished assemblage characterised by low abundances of a few species (the amphipod *Corophium volutator*, mysid shrimp *Gastrosaccus spinifer*, bryozoan *Electra monostachys* and springtails *Collembola* spp.) (Ref 9-23).

Table 9-12: Subtidal benthic survey results

Station	Sediment Type	TOC (%)	No. of Taxa (per m²)	No. of Individuals (per m²)	Total Biomass (g per m²)	Key Characterising Species (Number per m² Shown in Brackets)
1	Mud	6.45	8	190	0.02	*Tubificoides swirencoides* (60) *Nephtys* spp (40) *Diastylis rathkei* (20) Nematoda (20) *Streblospio shrubsolii* (20) *Corophium volutator* (10) *Macoma balthica* (10) *Nephtys hombergii* (10)
2	Mud	6.34	2	30	0.05	Nematoda (20) *Diastylis rathkei* (10)
3	Mud	5.37	1	10	<0.01	*Streblospio shrubsolii* (10)
4	Sandy Mud	4.38	2	120	0.06	*Nepthys* spp (110) *Diastylis rathkei* (10)

Station	Sediment Type	TOC (%)	No. of Taxa (per m²)	No. of Individuals (per m²)	Total Biomass (g per m²)	Key Characterising Species (Number per m² Shown in Brackets)
5	Sandy Mud	3.07	2	70	0.03	*Nepthys* spp (60) *Scoloplos armiger* (10)
6	Sandy Mud	3.77	5	100	1.79	*Nepthys* spp (60) *Arenicola marina* (10) *Austrominius modestus* (10) *Scoloplos armiger* (10)
7	Sandy Mud	4.50	3	80	0.11	*Nepthys* spp (40) *Diastylis rathkei* (20) Nematoda (20)
8	Sandy Mud	3.67	4	110	0.03	*Nepthys* spp (80) *Mytilus edulis* (10) Nematoda (10) *Tubificoides swirencoides* (10)

Fish

Humber Estuary overview

9.6.34 The Humber Estuary contains a varied fish fauna, totalling over 80 species with the majority common to most UK estuaries. The Humber Estuary fish assemblage comprises resident, nursery, seasonal and migratory species, typical of estuarine fish communities (Ref 9-57; Ref 9-58).

9.6.35 In general, the abundance and diversity of fish increases towards the mouth of the estuary. The outer reaches are characterised by a community dominated by inshore marine species such as whiting *Merlangius merlangus*, cod *Gadus morhua*, plaice *Pleuronectes platessa* and Dover sole *Solea solea*. The middle and upper reaches of the estuary support more euryhaline species including flounder *Platichthys flesus*, European eel *Anguilla anguilla*, gobies and sprat *Sprattus sprattus* (Ref 9-59; Ref 9-58).

9.6.36 The Humber Estuary supports a fish assemblage typical of other estuaries in north western Europe. However, a higher fish diversity than recorded in other estuaries in the UK has been found which may be due to the large catchment area and high fluvial flow allowing freshwater taxa to actively or passively occur in greater numbers into this estuary (Ref 9-60).

9.6.37 The baseline review presented in this chapter has primarily focused on key species which are of either commercial and/ or conservation importance. The functional guilds for estuarine fish used in Ref 9-57 which were based on published guild definitions (Ref 9-61; Ref 9-62) have been used to help summarise the life history and ecology of fish species occurring in the Humber Estuary, as follows:

a. Diadromous species (“D”): Species using estuaries as pathways of migration (for reproduction) between freshwater and the sea; migration from freshwater to sea water to breed (catadromous species, e.g. eel), and in the opposite direction (anadromous species, e.g., salmonids and lampreys).

b. Marine migrant species (“MM”): Marine species that spawn at sea and regularly enter estuaries in large numbers, thus having a temporary residence in the estuarine habitat; they usually are highly euryhaline species, able to move throughout the full length of the estuary, and spending much of their life within estuaries, using these habitats as nursery grounds or visiting them regularly at sub-adult and adult life stages.

c. Estuarine resident species (“ES”): Species that are able to reproduce and complete their life cycle in the estuary; as such they are highly euryhaline species, able to move throughout the full length of the estuary.

d. Marine straggler species (“MS”); Marine species usually associated with coastal marine waters but entering estuaries accidentally in low numbers. These are predominantly stenohaline species, occurring most frequently in the lower sections of the estuary.

e. Freshwater species (“F”): Species of freshwater origin that regularly or accidentally enter estuaries, in moderate to low numbers, moving varying distances down the estuary but often restricted to low-salinity, upper reaches of estuaries and to periods of freshwater flooding.

9.6.38 Table **9-13** provides a summary of species that have been recorded in the Humber Estuary (based on Ref 9-57) with further information on key species within each ecological guild provided below.

Table 9-13: Fish recorded in the Humber Estuary, grouped by ecological guilds.

Ecological guild	Species name	Common name	Ecological guild	Species name	Common name
Diadromous (D)	*Alosa alosa*	Allis shad	Marine stragglers (MS)	*Hyperoplus immaculatus*	Greater sandeel
	Alosa fallax	Twaite shad		*Hyperoplus lanceolatus*	Great sandeel
	Osmerus eperlanus	Smelt		*Callionymus lyra*	Dragonet
	Lampetra fluviatilis	River lamprey		*Taurulus bubalis*	Long-spined sea scorpion
	Petromyzon marinus	Sea lamprey		*Pollachius virens*	Coley / Saithe / Coalfish
	Salmo salar	Atlantic salmon		*Trisopterus minutus*	Poor cod
	Salmo trutta	Brown / sea trout		*Melanogrammus aeglefinus*	Haddock
	Gasterosteus aculeatus	3-spined stickleback		*Crystallogobius linearis*	Crystal goby
	Liza ramada	Thinlip mullet		*Pomatoschistus lozanoi*	Lozano's goby
	Anguilla	European eel		*Liparis montagui*	Montagu's seasnail
Marine migrants (MM)	*Atherina presbyter*	Sand smelt		*Gaidropsarus mediterraneus*	Shore rockling
	Clupea harengus	Atlantic herring		*Mullus surmuletus*	Striped red mullet
	Sprattus sprattus	Sprat		*Glyptocephalus cynoglossus*	Witch flounder
	Cyclopterus lumpus	Lumpsucker		*Microstomus kitt*	Lemon Sole

Ecological guild	Species name	Common name	Ecological guild	Species name	Common name
	Gadus morhua	Atlantic cod		*Scomber scombrus*	Mackerel
	Merlangius merlangus	Whiting		*Scophthalmus rhombus*	Brill
	Pollachius	Pollack		*Scyliorhinus* sp.	Spotted dogfish
	Trisopterus luscus	Pouting / Bib		*Buglossidium luteum*	Solenette
	Ciliata mustela	5-bearded rockling		*Entelurus aequoreus*	Snake pipefish
	Dicentrarchus labrax	Sea bass		*Echiichthys vipera*	Lesser weever
	Chelon labrosus	Thick lipped grey mullet		*Chelidonichthys cuculus*	Red gurnard
	Liza aurata	Golden grey and	Freshwater species (F)	*Cobitis taenia*	Spined loach
	Limanda limanda	Dab		*Abramis brama*	Common bream
	Platichthys flesus	Flounder		*Alburnus alburnus*	Common bleak
	Pleuronectes platessa	Plaice		*Blicca bjoerkna*	Silver bream
	Scophthalmus maximus	Turbot		*Carassius auratus*	Goldfish
	Solea solea	Dover sole		*Rutilus rutilus*	Roach
	Chelidonichthys lucernus	Tub gurnard		*Scardinius erythrophthalmus*	Rudd
	Eutrigla gurnardus	Grey gurnard		*Squalius cephalus*	Chub

Ecological guild	Species name	Common name	Ecological guild	Species name	Common name
Estuarine residents (ES)	*Agonus cataphractus*	Hooknose / Pogge		*Tinca tinca*	Tench
	Ammodytes tobianus	Lesser sandeel		*Gobio gobio*	Gudgeon
	Myoxocephalus scorpius	Shorthorn sculpin		*Leuciscus cephalus*	Chub
	Raniceps raninus	Tadpole-fish		*Leuciscus leuciscus*	Dace
	Aphia minuta	Transparent goby		*Rutilus x Alburnus alburnus*	Roach x Common bleak hybrid
	Pomatoschistus microps	Common goby		*Scardinius erythrophthalmus x Abramis brama*	Rudd x Common bream hybrid
	Pomatoschistus minutus	Sand goby		*Esox lucius*	Pike
	Liparis liparis,	Sea-snail		*Pungitius pungitius*	10-spined stickleback
	Pholis gunnellus	Rock gunnel		*Perca fluviatilis*	Perch
	Syngnathus acus	Greater pipefish		*Gymnocephalus cernuus*	Ruffe
	Syngnathus rostellatus	Lesser (Nillsons) pipefish			
	Zoarces viviparus	Viviparous blenny			

Source: Ref 9-57.

Marine migrant species

9.6.39 With respect to demersal fish considered to be marine migrant species, the Humber Estuary is considered to be an important nursery ground for several commercially important gadoids including whiting *Merlangius merlangus* and cod *Gadus morhua* (**Figure 9.3 [TR030008/APP/6.3]**). These species are typically the most abundant gadoids occurring in the Humber Estuary (Ref 9-28; Ref 9-57). Further information on the ecology of these species is provided in **Table 9-14**. Other gadoids commonly occurring include pouting *Trisopterus luscus* and pollack *Pollachius pollachius*.

9.6.40 A range of flatfish species are commonly recorded in the Humber Estuary region with flounder *Platichthys flesus* considered to be the most commonly occurring species. Nursery grounds for the commercially important Dover sole *Solea solea* and plaice *Pleuronectes platessa* occur in the region with these species also commonly occurring. Spawning grounds for Dover sole also occur in the region (**Table 9-14** and **Figure 9.3 [TR030008/APP/6.3]**). In addition, dab *Limanda limanda* and turbot *Scophthalmus maximus* are also recorded.

9.6.41 With respect to pelagic marine migrant species (free-swimming fish that inhabit the mid-water column), the clupeids sprat *Sprattus sprattus* and herring *Clupea harengus* are the most commonly occurring species. The Humber Estuary is considered to be nursery ground for herring (**Figure 9.3 [TR030008/APP/6.3]**). These pelagic species tend to have little association with the seabed and as a result are often distributed over widespread and indistinct grounds, often forming large shoals. Sea bass *Dicentrarchus labrax* is also frequently recorded in the Humber Estuary. Further information on the ecology of these species is provided in **Table 9-14**.

Table 9-14: Background information on the most commonly recorded marine migrant species occurring in the Humber Estuary

Species	Ecology
Whiting	In the Humber Estuary, whiting is recorded throughout most of the year with the highest abundances typically occurring in autumn. Most individuals recorded are juveniles, suggesting the Humber Estuary is predominantly used as a nursery ground.
Cod	In the Humber Estuary, the species occurs throughout most of the year but at lower frequency in the spring and summer. Cod is rarely recorded in intertidal and shallow subtidal habitats within the Humber Estuary. Most individuals recorded are juveniles, suggesting the Humber Estuary is predominantly used as a nursery ground. Spawning occurs offshore between January and April, peaking during February, with spawning grounds in the North Sea usually located in the pelagic zone at depths between 20 m and 100 m.

Species	Ecology
Flounder	Flounder occurs year-round in the Humber Estuary but with higher abundance typically recorded in late spring and summer. This species occurs in inshore waters to depths of 50 m and commonly reported using estuarine systems as nurseries. In the North Sea, the species generally spawn in spring in deeper marine waters, and larvae and early juveniles use selective tidal transport to migrate upstream to estuaries and rivers hence it may be regarded as semi-catadromous.
Dover sole	In the Humber Estuary, sole is recorded throughout most of the year with juvenile sole generally appearing in the Humber Estuary during the late spring and summer, after larvae and juveniles are transported here from adjacent coastal spawning areas by tidal currents. In the North Sea, the species generally reproduces in spring (March to late June, with a peak in April) in coastal waters, with spawning areas along the East coast of England from the Humber Estuary down to the Norfolk coast. In the North Sea, the nurseries are in shallow (< a few metres deep) sandy or muddy bottoms.
Plaice	Plaice occur throughout most of the year in the Humber Estuary with juveniles mainly recorded, suggesting the Humber Estuary is predominantly used as a nursery ground. Plaice spawn between January and April (with peak densities on spawning grounds in May). Spawning grounds in the UK are generally located at between 20m and 40m water depth with spawning grounds for plaice occurring in the marine areas near the mouth of the Humber Estuary. Plaice is a marine flatfish that uses estuarine habitats as nursery grounds. Plaice live mostly on sandy bottoms, although it can also be found on gravel and mud and on sandy patches in rocky areas, habitats and coastal zones as nursery grounds.
Dab	Dab occurring in the Humber Estuary are mainly juveniles, which suggests the estuary is predominantly used as a nursery ground. Dab spawn from January to June in the North Sea) with adults migrating to deeper waters between May and September.
Herring and sprat	Both sprat and herring occur in the Humber Estuary throughout most of the year but with a lower frequency in the spring and higher frequency in autumn (herring) and winter (sprat). Most individuals of both species recorded are juveniles or young individuals. Sprat is very abundant in the shallow coastal and estuarine areas of the North Sea in winter before spawning offshore between May and August in the North Sea. Herring spawn in shoals on coarse sand, gravel, shells and small stones in shallow water between 15 to 40m depth. Herring are demersal spawners, depositing their sticky eggs on coarse sand, gravel, small stones and rock. Young herring spend some time in the inshore areas before migrating offshore to join the adult population. Stocks that spawn in spring tend to use inshore spawning grounds whilst autumn and winter spawners tend to move offshore using the edges of ocean banks (e.g. around the Dogger Bank and off the Northumberland and Yorkshire coasts).
Sea bass	The occurrence of the sea bass in the Humber Estuary is typically sporadic. Data suggests that the estuary is predominantly used by juvenile/young stages, although the typically low frequency and abundance of the species suggest that the Humber Estuary is not an important nursery ground for sea bass.

Source: Ref 9-57; Ref 9-26; Ref 9-28; Ref 9-29.

Estuarine resident fishes

9.6.42 The sand goby *Pomatoschistus minutus* is the most frequently recorded goby species in the Humber Estuary, with common goby *P. microps* and the transparent goby *Aphia minuta* also occurring.

9.6.43 Sand gobies are frequently encountered in all areas of the estuary, but mainly in shallow intertidal areas in sandy and muddy habitats. Spawning occurs in shallow waters over an extended period, mostly during the spring and summer (sand goby spawn in summer while common goby spawn after their first winter between February and September, depending on the latitude), with multiple batches of eggs laid during this season (batch spawner).

9.6.44 Other estuarine resident species occurring in the Humber Estuary include lesser sandeel *Ammodytes tobianus*, hooknose *Agonus cataprachus*, tadpole fish *Raniceps raninus*, sea snail *Liparis liparis*, rock gunnel *Pholis gunnellus,* pipefish (greater pipefish *Sygnathus acus* and lesser pipefish *S. rostellatus*), and the viviparous blenny *Zoarces viviparus*.

Marine stragglers and freshwater species

9.6.45 Marine stragglers occur relatively infrequently with species recorded including the lesser weever *Echiichthys vipera* and dragonet *Callionymus lyra*.

9.6.46 The most commonly recorded freshwater species recorded in the Humber Estuary are roach *Rutilus rutilus* and common bream *Abramis brama* with other freshwater species recorded including and silver bream *Blicca bjoerkna* and rudd *Scardinius erythrophthalmus.* These species are typically recorded in the upper and mid sections of the Humber Estuary.

Diadromous migratory fish

9.6.47 Diadromous migratory fish (species migrating between freshwater and seawater) which occur in the Humber Estuary include salmonids (Atlantic salmon *Salmo salar* and sea trout *Salmo trutta*), lampreys (river lamprey *Lampretra fluviatilis* and sea lamprey *Petromyzon marinus*), European eel *Anguilla anguilla*, shads (allis shad *Alosa alosa* and twaite shad *Alosa fallax*) and European smelt *Osmerus eperlanus*. Of these species, European eel, European smelt and river lamprey have been the species most commonly recorded in sampling in the Humber Estuary (Ref 9-57). These species are all afforded protection under various legislation as described above.

9.6.48 Further information on the ecology and migration of these species is provided in **Table 9-15**.

Table 9-15: Background information on the ecology and distribution of diadromous migratory fish

Species	Ecology
European eel	European eel is a catadromous species which migrates to the marine environment (Sargasso Sea) to spawn. The larvae (leptocephali) then drift in the Gulf Stream and then North Atlantic Drift current for two to three years across the Atlantic Ocean to Europe and metamorphose into juveniles (elvers). The eels usually migrate into freshwater where they remain for many years. However, not all eels migrate into freshwater and some, predominantly males, remain in inshore coastal areas. The adults, commonly referred to as 'silver eels' during the spawning migration, leave river systems to return to the Sargasso Sea. The European Eel is widely distributed in the Humber catchment, although it is absent from the upper reaches of some rivers. In the Humber catchment, glass eels/elvers generally immigrate in spring and early summer, whereas the majority of silver eel emigrate in late summer and autumn. Eels are typically present in the Humber Estuary in the spring and summer. There is evidence that glass eels migrate upstream using 'Selective Tidal Stream Transport' whereby individuals with low locomotive capability, such as glass eels, move into the water column during flood tides to move up estuaries toward freshwater, typically remaining on or in the bottom substrate on ebb tides to avoid currents. Glass eel behaviour can be influenced by light levels, and although glass eels do migrate during the day there is an increase in activity during the night time, particularly in the first hours of darkness, when they also distribute closer to the surface. Some research suggests an increased abundance in glass eel catches during the new moon phase, but not the full moon, despite the fact that the tidal amplitude during both periods is similar. This could potentially be explained by the influence of light intensity on migration patterns. This effect of the lunar cycle and hence moonlight intensity is modulated by cloud cover and turbidity; therefore, one consequence is the fact that any lunar effect is not usually observed in highly turbid estuaries (Ref 9-127).
European smelt	The European smelt is a small anadromous species, widely distributed throughout the Atlantic and European waters, that migrates from estuaries and coastal waters into the lower reaches of rivers to spawn in early spring. Data suggests that the highest densities of smelt in the Humber Estuary occur in the spring and summer. The spawning migration starts in September to October, when mature fishes aggregate in estuaries to overwinter. Upriver migration starts in March to April when temperatures rise above 4 to 6°C and during rainy and stormy weather. Adult smelt generally enter the tidal Trent and Ouse from the Humber Estuary in early March and presumably return to the estuary after spawning.
River and sea lamprey	The river lamprey and the sea lamprey are both anadromous species, spawning in freshwater but completing part of their lifecycle in estuaries or at sea. The sea lamprey adult growth phase is short and lasts around two years. In this time, the species is parasitic, feeding on a variety of marine and anadromous fishes, including shad and salmon as well as herring, cod, haddock and basking sharks *Cetorhinus maximus.* Unlike sea lamprey, the growth phase of river lamprey is primarily restricted to estuaries. River lamprey have been frequently recorded in the Humber Estuary, with the Ouse catchment believed to support one of the

Species	Ecology
	most important river lamprey populations in the UK. In the Humber basin, river lamprey mainly enters the rivers from the estuary in autumn and then spawn in April. Sea lamprey spawning is almost entirely restricted to the Ouse catchment, principally the Rivers Ouse, Swale, Ure and Wharfe. The spawning migration of sea lamprey usually takes place in April and May when the adults start to migrate back into freshwater. The upstream migration of river lamprey takes place almost exclusively at night, with adults being sedentary and resting under rocks and riverbanks during the day.
Shads	The twaite and allis shad are anadromous species. Mature allis shad, having spent most of their lives in the sea stop feeding and move into the estuaries of large rivers, migrating into freshwater during late spring (April to June). Adult twaite shad stop feeding at sea and gather in the estuaries of suitable rivers in early summer (April and May), moving upstream to spawn from mid-May to mid-July. Within the Humber Estuary, most records of allis shad were juveniles while twaite shad adults.
Atlantic salmon and sea trout	Atlantic salmon and sea trout are anadromous species which migrate to freshwaters to spawn, whilst spending much of their life in the marine environment. They spawn in upper reaches of rivers, where they live for one to three years before migrating to sea as smolts. Atlantic salmon and sea trout smolts move out of the rivers and migrate downstream to the sea in spring, with the main movements occurring between April and June. At sea, salmon grow rapidly and after one to three years return to their natal river to spawn. The majority of adult salmon return to their natal rivers in autumn, although a small proportion returns in the spring and summer. In the Humbler catchment, Atlantic salmon has been mainly recorded from the upper reaches of the Ouse with brown/sea trout widespread in the upper reaches of the Humber catchment. In the Humber Estuary, most Atlantic salmon and sea trout have been recorded in the spring months between April and June and have been of smolt size.

Sources, Ref 9-57 Ref 9-127; Ref 9-127; Ref 9-128.

9.6.49 In summary**,** existing data suggests that the Humber Estuary supports a wide range of fish species including commonly occurring estuarine species and migratory species including diadromous fish. The Humber Estuary is also considered an important nursery ground for a range of commercially important fish species.

Immingham area

9.6.50 Fish data collected as part of intertidal fyke net and subtidal beam trawl surveys undertaken in May/June 2010 at sites located approximately 3 to 4km from the Project (between the Humber Sea Terminal and the Port of Immingham) has also been reviewed; despite the vintage of these data, they provide an indication of species which may be present (Ref 9-24)[4].

[4] A fyke net is a type of fish trap. It consists of long cylindrical netting bag usually with several netting cones fitted inside the netting cylinder to make entry easy and exit difficult. This fishing methods typically target demersal fish species.

9.6.51 The intertidal sampling (fyke netting) catch was dominated by flatfish species (flounder and sole) which consisted of 1+group flounder (born the year before) and mostly 0+ group sole, which suggested the area is used as a flatfish nursery. Single individuals of pollock, five-bearded rockling *Ciliata Mustela* and sand goby were also recorded (due to the small size of sand goby, this fish is normally misrepresented in fyke net catches).

9.6.52 Sand gobies and sole were the most abundant species recorded in the subtidal sampling (beam trawls) with other species recorded in lower abundances including whiting, five-bearded rockling and river lamprey. Sole caught in the subtidal survey were significantly larger than the specimens from the fyke nets. This is consistent with earlier research by Cefas that analysed annual 2m beam trawl and 1.5m push net survey data from the period 1981 to1995 and found that 0-group sole were highest in the 2m to 5.9m depth band (Ref 9-63).

9.6.53 The results of the most recently available Environment Agency TraC fish monitoring for the sites nearest the Project (seine netting/beam trawls at Foulholme Sands and otter trawls at Burcom) are summarised in **Table 9-16**. Beach seine netting targets both demersal and pelagic species occurring in shallow inshore locations. Beam and otter trawls target demersal species[5]. The Foulholme Sands surveys were undertaken twice a year in the spring and autumn with the Burcom surveys annually in the early winter. These monitoring sites are located approximately 3km to 5km from the Project and are shown in **Figure 9.4 [TR030008/APP/6.3]**. Data was available up to 2017 for Foulholme Sands and up to 2019 for Burcom (Ref 9-27).

Table 9-16: The total number of fish caught in fish surveys undertaken at Burcom and Foulhome Sands between 2013 and 2019

Species	Burcom Otter Trawl*	Foulhome Sands Beam Trawl**	Foulhome Sands Seine Net***
3-spined stickleback	-	1	41
5-bearded rockling	7	-	1
Bullrout / Short-spined sea scorpion	6	-	-
Cod	150	-	-
Common goby	7	-	8
Dab	48	-	
Dover sole	515	38	125
Dragonet	-	1	-

[5] These bottom trawls would only accidentally capture pelagic species (such as sprat or sea bass).

Species	Burcom Otter Trawl*	Foulhome Sands Beam Trawl**	Foulhome Sands Seine Net***
Flounder	81	48	63
Herring	14	4	205
Hooknose / Pogge	7	4	-
Lesser (Nillsons) pipefish	-	53	222
Lesser sandeel	-	1	-
Lesser weever	-	-	1
Plaice	4	114	1303
River lamprey	1	-	-
Sand goby	1220	21	752
Sea bass	-	1	35
Sea-snail	21	-	
Smelt	3	-	74
Sprat	9	-	20
Thin lipped grey mullet	-	-	9
Thornback ray/Roker	2		-
Turbot	-	-	4
Viviparous blenny	1	-	6
Whiting	164	10	45

* Surveys undertaken between 2013 and 2019.

** Surveys undertaken between 2014 and 2017.

*** Surveys undertaken between 2013 and 2017.

9.6.54 In summary, the most abundant species recorded in the surveys summarised in **Table 9-16** were sand gobies, the flatfish species plaice and Dover sole, the pelagic species herring and the gadoids whiting and cod. Other commonly occurring species recorded included the diadromous European smelt, flounder, 3-spined stickleback, dab and sprat. The results are consistent with data for the wider Humber Estuary region (described above) which suggests that these species are some of the most commonly occurring species in the region. In

addition, of note was a single individual River lamprey recorded in the Burcom Otter Trawl.

9.6.55 While these surveys do not overlap specifically with the Project, they are considered broadly representative of the fish assemblage that could be present within the dredge footprint and surrounding local area. This is because the surveys have used a variety of techniques to target different habitats within both the intertidal and subtidal. The TrAC surveys are also relatively contemporary and cover a range of seasons.

Marine mammals

Humber Estuary overview

Seals

9.6.56 The most commonly occurring marine mammals recorded in the Humber Estuary region are seals with populations of both grey seal *Halichoerus grypus* and common (harbour) seal *Phoca vitulina* occurring. Further information about the abundance and distribution of these species is provided below followed by a description of cetacean (whale, dolphin and porpoise) species occurring in the region.

9.6.57 The intertidal area at Donna Nook is the main haul out site in the region and is an important breeding ground for grey seals. This colony is located over 25km from the Project at the mouth of the Humber Estuary. In 2019, there were an estimated 67,789 grey seal pups born in Britain (Ref 9-64) with approximately 3% of the pup production occurring at Donna Nook. Breeding occurs once a year between October and December and the vast majority of seals in this colony breed at Donna Nook, with a few seals breeding on Skidbrooke Ridge, south of Donna Nook. Peak grey seal pup numbers in winter 2021/22 and 2020/21 at Donna Nook consisted of two, 122 and 2,214 seals respectively with numbers having increased substantially in recent years from under 100 pups born annually in the 1980s (see **Figure 9.5 [TR030008/APP/6.3]**).

9.6.58 The intertidal mudflats also provide an important habitat throughout the year for grey seals to haul out or rest, particularly during the spring when all grey seals (except young born the previous year) are moulting. Aerial seal counts undertaken in August 2021 recorded 3,897 grey seals hauled out at Donna Nook. Total numbers at this colony have increased from the low hundreds recorded in the late 1990s and early 2000s to counts over 4000-6,000 seals in more recent years (Ref 9-64) (see **Figure 9.6 [TR030008/APP/6.3]).**

9.6.59 Grey seals can undertake wide ranging seasonal movements over several thousand kilometres (Ref 9-65; Ref 9-34; Ref 9-35). However, while grey seals may range widely between haul out sites, tracking has shown that most foraging probably occurs within 100km of a haul-out site (Ref 9-36). Seals tagged at Donna Nook were recorded undertaking wide ranging movements in the outer Humber Estuary and approaches as well as more widely in the North Sea (Ref 9-35). This is reflected in high predicted at-sea densities of grey seals in the approaches to the Humber Estuary (Ref 9-34).

9.6.60 The Humber Estuary region also supports a small population of common seal. As for the grey seal, Donna Nook is also the key haul out site for common seals. A total of 122 common seals were recorded as part of annual aerial monitoring in the region in August 2021. Since the 1990s numbers have generally fluctuated between 100 and 400 counts annually in the region (Ref 9-36). Common seals typically forage within 40 km to 50 km of haul out sites (Ref 9-36).

Cetaceans

9.6.61 While over ten species of cetacean have been recorded in the southern and central North Sea, only harbour porpoise *Phocoena phocoena* is considered as regularly occurring throughout most of the year (Ref 9-30; Ref 9-66; Ref 9-33). In 2021, an abundance of 53,485 harbour porpoises was estimated for the southern North Sea region based on (SCANS) III data (Ref 9-37), with 159,632 harbour porpoise estimated for the UK portion of the North Sea harbour porpoise MU (Ref 9-135).

9.6.62 Near to the Humber Estuary, high densities of harbour porpoise have been recorded offshore from the Lincolnshire coast and the Holderness Coast (Ref 9-37; Ref 9-46). Harbour porpoise are also frequently recorded foraging in the Humber Estuary region with over 2,000 sightings since 2000 (Ref 9-30; Ref 9-32; Ref 9-31). Peak sightings and numbers occur in August, September and October. Although porpoises in the North Sea can give birth in any month of the year, breeding is typically seasonal with most births in June or July and a peak in mating in August (Ref 9-30).

9.6.63 Other cetacean species recorded in the Humber Estuary region more rarely include bottlenose dolphin *Tursiops truncatus*, common dolphin *Delphinus delphis*, white-beaked dolphin *Lagenorhynchus albirostris* killer whale *Orcinus orca* and minke whale *Balaenoptera acutorostrata* (Ref 9-30); Ref 9-31).

Immingham area

9.6.64 Marine mammal survey data or sighting records for the Immingham area are limited. However, given that seals (particularly grey seals) are regularly recorded foraging in the Humber Estuary, this species would be expected to occur relatively frequently in this area. For example, approximately ten to 15 grey seals were observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during recent benthic surveys as detailed in Ref 9-47. This haul out site is located approximately 4km northeast from the Project and around 3 - 4km from the dredge disposal sites (including transit routes). No seal haul out sites are known to occur nearer to the Project.

9.6.65 Harbour porpoises have also been regularly recorded foraging in this section of the Humber Estuary (Ref 9-30) (see **Figure 9.7 [TR030008/APP/6.3]**). This includes observations of a harbour porpoise foraging approximately 1-2km from the Project in the mid channel, offshore from Immingham during recent benthic surveys as detailed in Ref 9-47.

Future Baseline

9.6.66 In the absence of the Project, the current marine coastal processes would remain the same as described in the physical processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**).

9.6.67 Marine species are likely to become increasingly vulnerable to anthropogenic pressures in the future due to the predicted effects of climate change and ocean acidification in combination with more local pressures. The 2020 Marine Climate Change Impact Partnership report card (Ref 9-48) highlighted the following changes to marine ecology receptors could potentially occur during the operational phase of the Project as a result of climate change:

a. Sea-level rise could result in deeper waters and larger waves reaching saltmarsh and other intertidal habitats, causing erosion at the seaward edge.

b. Changes in patterns of rainfall or temperature changing vegetation composition of coastal saltmarsh communities.

c. Marine communities around the UK altering as ocean acidification increases.

d. Changing sea temperatures resulting in range shifts for both benthic species and mobile species (such as fish, marine mammals). This could result in a decline of some cold-water species around certain parts of the UK and an increase in the prevalence of non-native species.

e. Changing temperatures affecting spawning in some marine species as well as the timings of migrations.

f. Coastal waterbirds showing north-easterly shifts in the winter distributions in Europe.

g. Changes in prey distribution and availability, resulting in range shifts in some regional populations of marine mammals, fish and seabirds.

9.6.68 Data suggests that ecological changes linked to climate change (such as range shifts) are already occurring although there is currently a high degree of uncertainty with respect to predicting the magnitude of potential effects in the future.

9.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

9.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to marine ecology through the process of design development, and by embedding mitigation measures into the design, such as minimising the dredge requirements as far as possible and lighting design will be optimised to avoid any unnecessary light-spill on the water or foreshore habitats.

Standard Mitigation Measures

9.7.2 A number of measures will be undertaken to manage commonly occurring environmental effects. Although these are not likely to alter the assessment conclusions, they are considered to be standard good practice. These are as follows:

a. Even disposal deposition of dredged material: Targeting disposal loads in the central/deeper area of the disposal sites to reduce depth reductions. This will minimise the initial reduction in water depth and any environmental changes at the disposal sites.

b. Following biosecurity management procedures: Biosecurity control measures during construction will be included within the **Outline CEMP [TR030008/APP/6.5]** and existing biosecurity management procedures will be followed during operation.

c. Adhering to environmental management best practice: The potential risk from accidents and spillages/leaks during construction will be avoided or minimised by ensuring that the construction methods, proposed design and the contractual arrangements follow pollution prevention legislation and environmental management best practice.

9.8 Assessment of Likely Impacts and Effects

9.8.1 The assessment has identified potential likely significant effects on marine ecology receptors as a result of the construction and subsequent operation of the Project.

9.8.2 The physical processes assessment (**Chapter 16: Physical Processes [TR030008/APP/6.2]**), water and sediment quality assessment (**Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**) and underwater noise assessment (**Appendix 9.B [TR030008/APP/6.4])** have informed the outcomes of the marine ecology assessment.

9.8.3 Potential impacts on features of internationally designated sites (SACs, SPAs and Ramsar sites) have been assessed within the **Shadow HRA [TR030008/APP/7.6].**

9.8.4 With respect to marine ecology features of Humber Estuary SSSI, potential impacts on the following features were considered in the ES and **Shadow HRA [TR030008/APP/7.6]**:

a. Estuary (with its component habitats of intertidal mudflats and sandflats and coastal saltmarsh).

b. Fish and marine mammals (grey seal, river lamprey, sea lamprey).

9.8.5 All other habitat features of the SSSI are not considered to be in the zone of influence of potential effects. Coastal waterbird features of Humber Estuary SSSI are discussed in more detail in **Chapter 10: Ornithology** of the ES **[TR030008/APP/6.2].**

9.8.6 The nearest MCZ (Holderness Inshore) is located approximately 20km from the Project and does not overlap with the zone of influence. Furthermore, there are no mobile Features of Conservation Importance ("FOCI") that could overlap with any of the marine effects resulting from the Project. Overall, therefore, there is considered to be no potential for direct or indirect impacts on FOCI at this site. On this basis an MCZ Assessment is not considered to be required.

9.8.7 Cumulative impacts on marine ecology receptors that could arise as a result of other coastal and marine developments and activities in the Humber Estuary combined with the Project are considered as necessary as part of the cumulative impacts and in-combination effects assessment (**Chapter 25: Cumulative and In-Combination Effects** of the ES **[TR030008/APP/6.2]**).

Construction

9.8.8 This section provides an assessment of the potential impacts to marine ecology receptors as a result of the construction phase of the Project. Potential effects during the construction phase that are considered relevant are reviewed in **Table 9-17.** It should be noted that **Table 9-17** includes the rationale for the scoping in or out of individual pathways for further assessment.

Table 9-17: Potential effects during construction scoped in / out of further detailed assessment

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
Benthic habitats and species	Direct loss of intertidal and subtidal habitats and species as a result of the piles	Marine piling	Yes	Marine piling would result in the small loss of subtidal and intertidal habitat. This impact pathway has, therefore, been scoped into the assessment.
	Direct changes to benthic habitats and species as result of seabed removal during dredging	Capital dredge	Yes	Capital dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	N/A	This pathway relates to changes in habitat resulting directly from seabed removal and is, therefore, not considered relevant to the dredge disposal activity. Potential effects resulting from sediment deposition at the disposal site are discussed later in the table below.
	Direct changes to benthic habitats and species as a result of sediment deposition	Marine piling	No	Marine piling has the potential to result in the localised resuspension of sediment as a result of seabed disturbance. Sediment that settles out of suspension back onto the seabed as result of marine piling is expected to be negligible and benthic habitats and species are not expected to be sensitive to this level of change. This impact pathway has, therefore, been scoped out of the assessment.

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
		Capital dredge	Yes	Capital dredging has the potential to result in localised physical disturbance and smothering of seabed habitats and species (where the sediment settles out of suspension back onto the seabed). This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. This impact pathway has, therefore, been scoped into the assessment.
	Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes	Marine works (jetty structure and capital dredging)	Yes	The jetty structure and capital dredge have the potential to result in changes to hydrodynamic and sedimentary processes (e.g. flow rates, accretion and erosion patterns). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal exposure and tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the dredging could affect the quality of marine habitats and change the distribution of marine species. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	The disposal of dredged material at the marine disposal site has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges to physiological stresses caused by tidal

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				exposure and tidal elevation and, therefore, hydrodynamic and bathymetric changes caused by the disposal could affect the quality of marine habitats and change the distribution of marine species. This impact pathway has, therefore, been scoped into the assessment.
	Changes in water and sediment quality	Marine piling	No	The negligible, highly localised and temporary changes in suspended sediment levels (and related changes in sediment bound contaminants and dissolved oxygen) associated with bed disturbance during marine piling is considered unlikely to produce adverse effects in any species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway has, therefore, been scoped out of the assessment.
		Capital dredge	Yes	Changes in water quality during capital dredging could impact benthic habitats and species through an increase in suspended sediment concentrations (“SSC”) and the release toxic contaminants bound in sediments. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Changes in water quality could occur during dredged material disposal through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on benthic habitats and species. This impact pathway has, therefore, been scoped into the assessment.
		Surface water drainage	No	Standard measures to control surface water run-off during construction are embedded within the Project design for legislative compliance, and therefore it is very unlikely that

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				contaminated run-off would enter the Humber Estuary. This impact pathway has, therefore, been scoped out of the assessment.
	Underwater noise	Marine piling	Yes	Underwater noise generated by marine piling has the potential to affect benthic species. This will require further assessment and has, therefore, been scoped in.
		Capital dredge	Yes	Underwater noise generated by dredging has the potential to affect benthic species. This will require further assessment and has, therefore, been scoped in.
		Dredge disposal	Yes	Underwater noise generated by the movement of the dredger to and from the disposal site has the potential to affect benthic species if this disposal option is adopted. This will require further assessment and has, therefore, been scoped in.
	The potential introduction and spread of non-native species	Construction of marine infrastructure	Yes	Non-native species have the potential to be transported into the local area as a result of construction activity. This impact pathway has, therefore, been scoped into the assessment.
		Capital dredge	Yes	Non-native species have the potential to be transported into the local area on the hulls of dredging vessels. Non-native invasive species also have the potential to be transported via vessel ballast water. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Non-native species have the potential to be transported into the local area on the hulls of dredging vessels. Non-native invasive species also have the potential to be transported via

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				vessel ballast water. This impact pathway has, therefore, been scoped into the assessment.
	Damage to sensitive habitats as a result of changes in air quality.	Road traffic emissions	No	There are no designated nature conservation receptors within 200m of a road that exceeds the Institute of Air Quality Management ("IAQM") and Environmental Protection UK ("EPUK") screening guidance on local roads (see **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**), below which a road traffic impact is unlikely to contribute to a significant effect on local air quality. There are also no roads that exceed the National Highways DMRB screening criteria on the Strategic Road Network (see **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**). This impact pathway has, therefore, been scoped out of the assessment.
		Construction vessel emissions	No	The assessment has considered a scenario of peak construction vessel operation (see **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**)**.** Given the limited number of construction vessel emissions sources, the frequency of operation and distance between source and sensitive receptors (over 3km away from the nearest saltmarsh habitat), it is considered highly unlikely that this source could contribute to a significant effect on local air quality. Although there are areas of designated habitat within the Humber Estuary SAC/SPA/Ramsar/SSSI that are nearer to the source of vessel emissions, these are intertidal mudflats and subtidal estuarine habitats that do not support any rooted plants that could be sensitive to vessel emissions. While intertidal mudflats can be sensitive to nutrients in some circumstances, where they cause excessive macroalgal (seaweed) growth, the APIS notes that even for saltmarsh *'Overall N deposition*

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				[from atmosphere] is likely to be of low importance for these systems as the inputs are probably significantly below the large nutrient loadings from river and tidal inputs'. It is also considered that the Humber Estuary is likely to be at relatively low risk of smothering from macroalgae, given the role of high sediment load in limiting sunlight penetration and strong wave action in breaking up macroalgae mats. This impact pathway has, therefore, been scoped out of the assessment.
Fish	Direct loss or changes to fish populations and habitat	Marine piling	No	There is the potential for impacts to fish as a result of habitat loss due to installation of piles and the footprint of the Project. However, the direct footprint of the marine piling only covers a highly localised area with the mobile nature of fish allowing them to utilise nearby areas. This impact pathway has, therefore, been scoped out of the assessment.
		Capital dredge	Yes	Backhoe dredging can directly remove fish and fish eggs in the bucket. In addition, capital dredging has the potential to result in seabed disturbance and smothering of seabed habitats and species. These changes have the potential to impact on fish species through potential changes in prey resources and the quality of foraging, nursery and spawning habitats. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Disposal at the marine disposal site will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. These changes have the potential to impact on fish species through potential changes in prey resources and the quality of

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				foraging, nursery and spawning habitats. This impact pathway has, therefore, been scoped into the assessment.
	Indirect changes to seabed habitats for fish	Marine piling	No	Marine piling has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, such effects will be negligible and highly localised and will cause no direct changes to fish habitat. This impact pathway has, therefore, been scoped out of the assessment.
		Capital dredge	No	The capital dredge has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, as described in more detail in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**), negligible changes in estuary processes are predicted. The predicted changes are not expected to modify existing subtidal habitat types found in the area. Indirect effects on fish habitats (feeding, spawning and nursery areas) are, therefore, considered to be negligible. On this basis, this pathway has been scoped out of the assessment.
		Dredge disposal	No	Dredge disposal has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, as described in more detail in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**), only minor changes in flow rates and subtidal seabed morphology are predicted which are not expected to modify existing subtidal habitat types found in the area (i.e. mobile

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				sand habitats characterised by an impoverished infaunal assemblage). Given the offshore location of the disposal site, no changes in wave regime are predicted. Indirect effects on fish habitats (feeding, spawning and nursery areas) are, therefore, considered to be negligible. On this basis, this pathway has been scoped out of the assessment.
	Changes in water and sediment quality	Marine piling	No	The expected highly localised and temporary changes in suspended sediment levels and related changes in sediment bound contaminants and dissolved oxygen associated with bed disturbance during marine piling are considered highly unlikely to produce adverse effects in any fish species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway has, therefore, been scoped out of the assessment.
		Capital dredge	Yes	Changes in water quality during capital dredging could impact fish species through an increase in SSC and the release of toxic contaminants bound in sediments. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Changes in water quality could occur during dredged material disposal through the deposition of material causing elevated SSC and contaminant levels. This could potentially impact on fish species. This impact pathway has, therefore, been scoped into the assessment.
	Underwater noise	Marine piling	Yes	During marine piling, there is the potential for noise disturbance to fish. Percussive (impact) and vibro marine piling will produce underwater noise above background

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				conditions and at a level that may cause a risk of injury and behavioural changes to fish in the vicinity of the Project. This impact pathway has, therefore, been scoped into the assessment.
		Capital dredge	Yes	Elevated underwater noise and vibration levels caused by the action of the dredger could potentially affect fish. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Underwater noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect fish. This impact pathway has, therefore, been scoped into the assessment.
Marine mammals	Direct loss or changes in marine mammal foraging habitat	Construction (marine piling, capital dredge and dredge disposal)	No	There is the potential for impacts to marine mammals as a result of changes to marine mammal foraging habitat and prey resources. However, the footprint of the Project only covers a highly localised area that constitutes a negligible fraction of the known ranges of local marine mammal populations. This impact pathway has, therefore, been scoped out of the assessment.
	Changes in water and sediment quality	Marine piling	No	The negligible, highly localised and temporary changes in suspended sediment levels and related changes in sediment bound contaminants and dissolved oxygen associated with bed disturbance during marine piling, is considered highly unlikely to produce adverse effects in any marine mammal species. The potential for accidental spillages will also be negligible during construction through following established industry guidance and protocols. This impact pathway has, therefore, been scoped out of the assessment.

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
		Capital dredge	No	The plumes resulting from dredging are expected to have a relatively minimal and local effect on SSC in the vicinity of the Project (as described in more detail in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during capital dredging (Ref 9-49). Given the limited extent of sediment dispersal significant elevations in water column contamination are unlikely. This will be confirmed following analysis of the uplift in contaminant concentrations in the water column once sediment sampling and analysis has been carried out. In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Ref 9-49). Furthermore, potential for accidental spillages will also be negligible during all phases through the application of established industry guidance and protocols. The potential for water quality impacts to marine mammals has, therefore, been scoped out of the assessment.
		Dredge disposal	No	The plumes resulting from dredge disposal are expected to have a relatively minimal and local effect on SSC (as described in more detail in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**). Marine mammals are well adapted to turbid conditions and, therefore, not sensitive to the scale of changes in SSC predicted during disposal (Ref 9-49). Given the limited extent of sediment dispersal significant

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				elevations in water column contamination are unlikely. This will be confirmed following analysis of the uplift in contaminant concentrations in the water column once sediment sampling and analysis has been carried out. In addition, the temporary and localised changes in water column contamination levels are considered unlikely to produce any lethal and sub-lethal effects in these highly mobile species (the concentrations required to produce these effects are generally acquired through long-term, chronic exposure to prey species in which contaminants have bioaccumulated) (Ref 9-49). Furthermore, potential for accidental spillages will also be negligible during construction through the application of established industry guidance and protocols. The potential for water quality impacts to marine mammal has therefore been scoped out of the assessment.
	Collision risk	Construction, dredging and dredge disposal	No	Vessels involved in construction and dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over 10 knots are considered to have a much higher probability of causing lethal injury (Ref 9-50). Furthermore, the region is already characterised by heavy shipping traffic. The additional movements due to construction activity (including capital dredging) will only constitute a small increase in vessel traffic in the area which will also be temporary in nature. In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (Ref 9-51; Ref 9-52). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (Ref 9-52). In addition, marine mammals foraging within the Humber Estuary region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway has, therefore, been scoped out of the assessment.
	Underwater noise	Marine piling	Yes	Percussive (impact) and vibro marine piling will produce underwater noise above background conditions and at a level that may cause a risk of injury and behavioural changes to marine mammals in the vicinity of the Project. This impact pathway has, therefore, been scoped into the assessment.
		Capital dredge	Yes	Elevated noise and vibration levels caused by the action of the dredger could potentially affect marine mammals by inducing adverse behavioural reactions. This impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	Yes	Elevated noise and vibration levels caused by the movement of the dredger to and from the disposal site could potentially affect marine mammals by inducing adverse behavioural reactions. This impact pathway has, therefore, been scoped into the assessment.
	Visual disturbance of hauled out seals	Construction, dredging and dredge disposal	No	The nearest established breeding colony for grey seals is located over 25km away at Donna Nook. Approximately ten to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during

Receptor	Impact Pathways/ Potential Effects	Project activity	Included in assessment?	Justification
				recent benthic surveys as detailed in Ref 9-47. This haul out site is located approximately 4km north-east from the Project and around 3-4km from the dredge disposal sites (including transit routes). No seal haul out sites are known to occur nearer to the Project. Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Ref 9-67). The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800 m although seals generally only disperse into the water at distances <150-200 m (Ref 9-68; Ref 9-69; Ref 9-70; Ref 9-71). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5m and 25m resulted in over 64 % of seals entering the water, but at distances of between 50m and 100m only 1 % entered the water (Ref 9-72). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal cycle (Ref 9-73). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the Project) are out of the zone of influence of any potential visual disturbance effects as a result of dredging, dredge disposal or construction activity. The potential for disturbance to hauled out seals has, therefore, been scoped out of the assessment.

Benthic Habitats and Species

9.8.9 This section contains an assessment of the potential impacts to benthic ecology receptors as a result of the construction phase of the Project. The following impact pathways have been assessed:

a. Direct loss of intertidal habitat as a result of the piles.

b. Direct loss of subtidal habitat as a result of the piles.

c. Changes to benthic habitats and species as result of the removal of seabed material during dredging.

d. Changes to benthic habitats and species as a result of sediment deposition during dredging and dredge disposal.

e. Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes during marine works (jetty structure and capital dredging) and dredge disposal.

f. Changes in water and sediment quality during capital dredging and dredge disposal.

g. Underwater noise and vibration on invertebrates during marine piling, capital dredging and dredge disposal.

h. Introduction and spread of non-native species during construction, capital dredging and dredge disposal.

Direct loss of intertidal habitat as a result of the piles

General scientific context

9.8.10 The impact of direct intertidal habitat loss can involve building over marine habitats (such as reclamation) or the permanent physical removal of substratum and associated organisms from the seabed. Direct habitat loss can also occur due to deepening as a result of dredging causing a change from an intertidal to a subtidal environment.

9.8.11 Intertidal habitats are sensitive to physical loss at locations where new structures are introduced onto the seabed (i.e., within the development ‘footprint’ of these structures). The significance of such losses will vary on a site-by-site basis in response to differences in the extent and duration of the losses as well as the relative value of the habitats in question. The value of the habitats is, in turn, reflected by the species that are present and level of statutory and non-statutory protection afforded to them. As any effects are very much dependent upon site specific considerations, a generic scientific review is not appropriate, and the focus of the impact assessment has been based on site-specific considerations.

Project impact assessment

9.8.12 The piles will cause a direct loss of up to 0.00158 ha of intertidal mudflat habitat.

9.8.13 The intertidal habitat loss as a result of the marine piling represents approximately 0.000004 % the Humber Estuary SAC and approximately 0.000017 % of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC[6].

9.8.14 This loss also represents 0.000004 % of the Humber Estuary SPA/Ramsar[7]. When considering this in the context of intertidal area, the area of loss represents approximately 0.000018 % of intertidal foreshore habitats[8] and approximately 0.000025 % of mudflat[9] within the SPA.

9.8.15 This habitat loss is therefore negligible in extent in the context of the Humber Estuary SAC, SPA and Ramsar. The **Shadow HRA [TR030008/APP/7.6]** considers potential effects of this loss on these designated sites in more detail.

9.8.16 The loss of intertidal habitat due to marine piling will be highly localised and considered *de minimis* in extent. The loss is also considered to be a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary. Potential effects of direct intertidal habitat loss on coastal waterbirds are considered in **Chapter 10: Ornithology** of the ES **[TR030008/APP/6.2]**.

9.8.17 Based on the evidence provided above, the probability of habitat loss occurring is high and the magnitude of potential impacts is considered to be negligible. Exposure to change is, therefore, negligible. While the sensitivity of species to direct habitat loss, is considered to be high for all benthic habitats and species within the footprint (given the lack of recoverability), vulnerability is assessed as none, given the negligible exposure to change. While the benthic community is common throughout the region, it is noted that the intertidal habitat itself is protected (both as a qualifying feature of the Humber Estuary SAC and a NERC Habitat of Principle Importance) and of functional importance for waterbirds. Notwithstanding that importance is considered to be high, taking all of these factors into account (including magnitude of change and vulnerability to change), the potential effects arising from the direct loss of intertidal are considered to be **insignificant**.

Direct loss of subtidal habitat as a result of the piles

General scientific context

9.8.18 The impact of direct habitat loss can involve building over marine habitats (such as reclamation) or the permanent physical removal of substratum and associated organisms from the seabed. Direct habitat loss can also occur due to deepening as a result of dredging causing a change from an intertidal to a subtidal environment.

[6] Based on the extents given in the Standard Data Form on the JNCC website (Ref 9-38)
[7] Based on the extents given in the Standard Data Form on the JNCC website (Ref 9-39)
[8] OBJ Intertidal Substrate Foreshore (England and Scotland)
[9] Based on using mudflat data layer of the Priority Habitat Inventory (England).

9.8.19 Subtidal habitats are sensitive to physical loss at locations where new structures are introduced onto the seabed (i.e., within the development 'footprint' of these structures). The significance of such losses will vary on a site-by-site basis in response to differences in the extent and duration of the losses as well as the relative value of the habitats in question. The value of the habitats is, in turn, reflected by the species that are present and level of statutory and non-statutory protection afforded to them. As any effects are very much dependent upon site specific considerations, a generic scientific review is not appropriate in this case and the focus of the impact assessment is based on site-specific considerations.

Project impact assessment

9.8.20 Marine piling in the subtidal area will result in the direct loss of up to 0.051 ha of seabed habitat. This habitat represents approximately 0.00014 % of the Humber Estuary SAC.

9.8.21 The project-specific subtidal survey (**Section 9.6** and **Appendix 9.A [TR030008/APP/6.4]**) recorded a highly impoverished assemblage characterised polychaetes (such *Nephtys* spp, *Streblospio shrubsolii* and *Scoloplos armiger*), nematodes, oligochaetes *Tubificoides* spp and crustacean *Diastylis rathkei)*.

9.8.22 The loss in subtidal habitat as a result of the piles is considered negligible in the context of extent of the overall amount of similar marine habitats found locally in the Humber Estuary. All the species recorded were considered commonly occurring and not protected. Furthermore, faunal assemblage recorded are also considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (Ref 9-23; Ref 9-24; Ref 9-22).

9.8.23 Based on the evidence provided above, the probability of habitat loss occurring is high and the magnitude of potential impacts is considered to be negligible. Exposure to change is, therefore, negligible. While the sensitivity of species to direct habitat loss, is considered to be high for all benthic habitats and species within the footprint (given the lack of recoverability), vulnerability is assessed as none given the negligible exposure to change. Importance is considered to be moderate as the subtidal species found in the area are commonly occurring and of low conservation concern although subtidal habitats form a component of the 'Estuaries' feature of the SAC. On this basis, the effect resulting from direct habitat loss on subtidal benthic habitats and species is assessed as **insignificant**.

Direct changes to benthic habitats and species as result of the removal of seabed material during dredging

General scientific context

9.8.24 Dredging causes a direct physical removal of sediments, causing a modification to the existing subtidal and intertidal habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site.

9.8.25 The speed of recovery of the temporarily disturbed areas is dependent on the scale and timing of the disturbance, the life histories of species and the stability and diversity of the benthic community present. For example, while the opportunistic bivalve *Abra* spp. is vulnerable to physical disturbance (due to its fragile shell), the species is considered to have a high recoverability due to a high fecundity and larval dispersal rate (Ref 9-142; Ref 9-74). Furthermore, a regularly disturbed sedimentary habitat with a low diversity benthic assemblage is likely to recover more quickly (i.e., return to its disturbed or 'environmentally-stressed' baseline condition) than a stable habitat with a pre-existing mature and diverse assemblage (Ref 9-143).

9.8.26 In general, where studies have been undertaken to understand the effects of physical disturbance, they have shown recolonisation of deposited sediments by benthic species to be quite rapid (Ref 9-133). Sites are initially colonised by short lived, fast growing, opportunistic species ('r-selected') that are tolerant of high levels of disturbance; infaunal species dominate, particularly polychaetes worms. In time, these are succeeded by longer lived, slower growing species with a lower tolerance for disturbance (Ref 9-144; Ref 9-145). Rates of recovery reported in reviewed literature suggest that a recovery time of six to 24 months is characteristic of many mobile sands and estuarine muds where frequent disturbance of the deposits precludes the establishment of long-lived communities (Ref 9-78; Ref 9-146; Ref 9-133). In contrast, a community of sands and gravels may take two to three years to establish, depending on the proportion of sand and level of environmental disturbance by waves and currents (Ref 9-144; Ref 9-147).

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9.8.27 The capital dredge will remove approximately 4,000m³ of material over a maximum area of approximately 10,000m² of subtidal habitat. It is expected that the material will be removed with a backhoe dredger.

9.8.28 Following the capital dredge, it is likely that the dredge pocket would provide similar habitat to that under pre-dredge conditions. The baseline benthic surveys predominantly recorded surface sediment within and near to the dredge footprints with a high silt content (i.e., mud and sandy mud) (**Section 9.6** and **Appendix 9.A [TR030008/APP/6.4]**). Sub surface sampling in the capital dredge footprint recorded sediments from most sampling locations dominated by silt material (see **Appendix 2.A [TR030008/APP/6.4]**.

9.8.29 The project-specific subtidal survey (**Section 9.6** and **Appendix 9.A [TR030008/APP/6.4]**) recorded a highly impoverished benthic community which is likely to reflect the existing high levels of physical disturbance in the area due to strong tidal currents and sediment movement.

9.8.30 Samples were characterised by polychaetes (such *Nephtys* spp, *Streblospio shrubsolii* and *Scoloplos armiger*), nematodes, oligochaetes *Tubificoides* spp and crustacean *Diastylis rathkei.* These species are typically fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than 1-2 years and for some species within a few months (Ref 9-74; Ref 9-75; Ref 9-76). All the species recorded are commonly occurring and not

protected. In addition, the faunal assemblage recorded is considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (Ref 9-23; Ref 9-24; Ref 9-22).

9.8.31 Based on the evidence provided above in the scientific review and applying the project impact assessment methodology, the magnitude of the change to the subtidal habitats and associated benthic species is considered to be small. Therefore, while the probability of occurrence is high, the overall exposure is assessed as low for subtidal habitats. The sensitivity of subtidal habitats to seabed disturbance within the dredge footprint is considered to be low given the high recoverability rates. Vulnerability is, therefore, assessed as low. While subtidal communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Importance is, therefore, considered to be **moderate**. Overall, however, the potential effect is assessed as **insignificant to minor**.

9.8.32 It should be noted that this assessment specifically relates to the effects of the capital dredge. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). However, as this could cause disturbance to the seabed on a very periodic basis, changes to benthic habitats and species as result of the removal of seabed material during maintenance dredging is considered in the operational section.

Direct changes to benthic habitats and species as a result of sediment deposition during dredging and dredge disposal

General scientific context

9.8.33 Sediments suspended and dispersed during the marine works, dredging and disposal have the potential to resettle over the seabed. This potential blanketing or smothering of benthic species may cause stress, reduced rates of growth or reproduction and in the worst cases the effects may be fatal (Ref 9-148; Ref 9-149).

9.8.34 Habitats within estuarine and coastal environments have highly fluctuating conditions including the resuspension and deposition of sediments on a daily basis (through tidal action), lunar cycles (due to the differing influences of spring and neap tides) and on a seasonal basis (due to storm activity and conditions of extreme waves). Subtidal and intertidal habitats are, therefore, characterised by such perturbations and the biological communities of these environments are well adapted to survival under fluctuating conditions.

9.8.35 If the amount of sediment deposited is too great to allow species to survive burial, then recovery occurs via re-colonisation and/or migration to the new sediment surface (Ref 9-150; Ref 9-151). In general, the rate of recovery is dependent upon just how stable and diverse the assemblage was in the first place. A regularly disturbed sedimentary habitat with a low diversity benthic assemblage is likely to recover more quickly (i.e., return to its disturbed or 'environmentally-stressed' baseline condition) than a stable habitat with a pre-existing mature and diverse assemblage. A study by Bolam *et al.* (Ref 9-152), for instance, concluded that the relatively rapid recovery observed at a location on the Crouch Estuary was due to the opportunistic nature of the invertebrate assemblages and the

dispersive behaviour of the dominant species that were present before the material was deposited. Furthermore, in cases where the quantity and type of sediment deposited does not differ greatly from natural sedimentation, e.g., of similar particle size, the effects are likely to be relatively small as many of the species are capable of migrating up through the deposited sediments (Ref 9-153). Dauvin *et al* (Ref 9-133) undertook an experimental study between 2016 and 2017 to identify changes of the benthos at ten stations on six surveys at a dredge disposal site. The study found that the impact of dredging remains local, and the benthic habitats display a high degree of resilience with rapid recovery of the community after the cessation of disturbance.

9.8.36 The Marine Evidence based Sensitivity Assessment ("MarESA") approach (Ref 9-140found that benthic communities in both sandy and muddy estuarine sediments are typically considered to be tolerant to the deposition of up to 5cm of fine material in a single event with burrowing species considered able to relocate to preferred depths through this level of deposition. Deposition of greater depths of fine sediment could result in some mortality although evidence suggests that some characterising species are likely to be able to reposition. Bivalve and polychaete species have been reported to migrate through depositions of sediment greater than 30cm (Ref 9-74; Ref 9-146; Ref 9-76; Ref 9-75). A previous review by the University of Hull also concluded that benthic invertebrates in sediments are able to adapt and readjust if sediment laid is placed as thin veneers over several days although they can also tolerate moderate amounts (20cm) of material being deposited at one time (Ref 9-154).

Project impact assessment: Capital Dredging

9.8.37 Sediment changes that are predicted to occur as a result of the capital dredge are presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**. In summary, maximum siltation as a result of the capital dredge within about 500m up and down the estuary from the edge of the dredge pocket is predicted to be around 1mm. Beyond this area, deposition levels are predicted to be negligible. Furthermore, once on the bed, the deposited material will return to the background system i.e. it will be put back into suspension on subsequent peak flood or ebb tides to be further dispersed. The project-specific subtidal survey (**Section 9.6** and **Appendix 9.A [TR030008/APP/6.4]**) recorded highly impoverished assemblage characterised polychaetes (such *Nephtys* spp, *Streblospio shrubsolii* and *Scoloplos armiger*), nematodes, oligochaetes *Tubificoides* spp and crustacean *Diastylis rathkei*. All the species recorded were considered commonly occurring and not protected.

9.8.38 The benthic species occurring within and near to the dredge area typically consist of burrowing infauna (such as polychaetes, oligochaetes or bivalves), which are considered tolerant to some sediment deposition. Based on evidence provided in relevant MarESA assessments, the characterising species recorded in the project-specific subtidal survey (described above) above are considered tolerant to deposition of at least 50mm with many species considered capable of burrowing through much greater levels of sediment deposition. On this basis, the predicted millimetric changes in deposition are, therefore, considered unlikely to cause smothering effects as described above. In addition, the species recorded

in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than one to two years and for some species within a few months (Ref 9-74; Ref 9-75; Ref 9-76).

9.8.39 Deposition of sediment as a result of dredging will be highly localised and similar to background variability. Magnitude of change is, therefore, assessed as negligible. Probability of occurrence is high and thus the overall exposure to change is negligible. Based on the evidence provided above, sensitivity of subtidal habitats within the vicinity of the proposed works to increased smothering is considered to be low given that these species are well adapted to survival under fluctuating sediment conditions and have high recoverability rates. Vulnerability is therefore assessed as none. While subtidal communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Importance is, therefore, considered to be **moderate**. The overall potential impact of deposition on benthic features is assessed as **insignificant**.

Project impact assessment: Disposal

9.8.40 The requirement for disposal of dredged material at sea associated with the Project would be fulfilled at licensed disposal sites HU056 and HU060 (see **Chapter 2: The Project** of the ES **[TR030008/APP/6.2]**).

9.8.41 The assessment of the sediment changes that are predicted to occur as a result of the capital dredging disposal is presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**. In summary, sedimentation resulting from the disposal plume is predicted to be generally in the range of 1 to 2mm at distances of up to around 1km from the disposal sites. Further up and down estuary, maximum sedimentation as a result of the disposal activities is generally predicted to be negligible.

9.8.42 The disposal sites are located in the mid channel and are subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This is reflected in a generally impoverished assemblage at both disposal sites. In addition millions of wet tonnes of dredge sediment are disposed of at HU060 annually which will also cause some disturbance due to sediment deposition.

9.8.43 The benthic species recorded within and adjacent to the disposal sites include mobile infauna (such as errant polychaetes e.g., *Arenicola* spp. and amphipods) which are able to burrow through sediment. They are, therefore, considered tolerant to some sediment deposition. In addition, characterising species typically have opportunistic life history strategies, with short life histories (typically two years or less), rapid maturation and the production of large numbers of small propagules which makes them capable of rapid recoverability should mortality as a result of smothering occur (Ref 9-77; Ref 9-74; Ref 9-75; Ref 9-76; Ref 9-78). On this basis, any effects are considered to be temporary and short term.

9.8.44 In summary, deposition in the wider area surrounding the disposal ground is expected to be in the order of millimetres. Sedimentation of this scale is unlikely to result in significant smothering effects to most faunal species with recoverability expected to be high.

9.8.45 The magnitude of the change during disposal is considered to be negligible. Probability of occurrence is high, and the overall exposure is, therefore, negligible. Given that habitats and species within and around the disposal site are well adapted to disturbed conditions with high recoverability rates, sensitivity is considered to be low and thus vulnerability is considered to be none. The benthic habitats and associated species that overlap with the changes brought about during disposal are of low ecological value but characteristic of the 'Sandbanks which are slightly covered by sea water all the time' feature of the Humber Estuary SAC. Therefore, importance is assessed as high. The overall potential impact of deposition on benthic features is assessed as **insignificant.**

Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes

General scientific context

9.8.46 Port or harbour structures (such as piles, breakwaters, coastal defences, jetties or quay walls) can cause changes to hydrodynamics (flow speeds, flow direction, waves, water levels) and seabed morphology Ref 9-155; Ref 9-156; Ref 9-157). Such changes have the potential to affect habitat quality and result in changes to the diversity, abundance and biomass of intertidal and subtidal species.

9.8.47 Dredging can cause direct habitat changes resulting from seabed removal and sediment deposition, as well as indirect habitat changes linked to hydrodynamic and sedimentary processes. Deepening or widening of channels during dredging can change seabed bathymetry and potentially alter flow patterns (speed/ direction), wave exposure and cause tidal amplification (Ref 9-158; Ref 9-159; Ref 9-160).

9.8.48 These hydrodynamic changes can lead to changes in sediment transport and also patterns of emersion/immersion as well as erosion/accretion of marine sedimentary habitats such as mudflats and sandbanks (Ref 9-158; Ref 9-138). For example, Cox *et al.* (Ref 9-160) found that saltmarsh retreat was related to an increase in the tidal prism brought about by dredging operations to maintain or increase the depth of the main navigable channel of the Westerschelde Estuary in the Netherlands. The greater frequency with which the high tides reached the edge of the fringing marshes increased the risk of erosion.

9.8.49 Increased flow rates can also increase scouring and bed disturbance of subtidal habitats which can cause a reduction in diversity and an increase in more opportunistic species. Reductions in water flow could also increase siltation levels which could change the habitat type of a seabed and lead to sedimentation (Ref 9-77). Marine invertebrates inhabiting sand and mud habitat show different tolerance ranges of physiological stresses caused by exposure and tidal elevation. This can lead to zonation (Ref 9-161). Bathymetric changes caused by dredging could, therefore, change the vertical distribution of marine habitats if

post-dredging water depths were outside the range at which specific biotopes exist.

Project impact assessment: Marine works

9.8.50 An assessment of the hydrodynamic and sediment regime changes that are predicted to occur as a result of the marine works are presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**. It should be noted that predicted changes are primarily as a result of the presence of the jetty with the effects due to the capital dredge having a negligible, localised effect.

9.8.51 Slight increases to local peak ebb current speed landward of the berth pocket are predicted to cause a limited amount of erosion of the bed along part of the lower intertidal (at the elevation of Mean Low Water Springs) beneath the landward ends of the proposed jetty. This will result in a potential indirect loss in intertidal area (up to approximately 0.03ha). The assessment indicates that once the softer upper layer is removed, the harder, more consolidated, underlayer of bed material is unlikely to erode further. This calculation represents a worst-case assessment of potential elevation changes and has been considered on a precautionary basis. The level of predicted change is at the limit of the accuracy of the modelled data and, in real terms, is likely to be immeasurable against the context of natural variability (as a result of storm events, for example).

9.8.52 The intertidal habitat loss represents approximately 0.00008 % the Humber Estuary SAC and approximately 0.00032 % of the 'mudflats and sandflats not covered by seawater at low tide' feature of the Humber Estuary SAC[10].

9.8.53 The predicted intertidal loss also consists of a very narrow strip on the lower shore around the sublittoral fringe and it is considered that this loss in mudflat extent will not change the overall structure or functioning of the nearby mudflats within the Port of Immingham area or more widely in the Humber Estuary.

9.8.54 Based on these factors, the probability of occurrence is considered to be high on a precautionary basis with the magnitude of change from these highly localised and small scale predicted effects due to hydrodynamic and sedimentary processes is considered to be negligible on marine habitats and species. Exposure is consequently assessed as negligible. While the sensitivity of species to direct habitat loss, is considered to be high for all benthic habitats and species within the footprint (given the lack of recoverability), vulnerability is assessed as none, given the negligible exposure to change.

9.8.55 Intertidal habitat is considered to be of high importance (a qualifying feature of the Humber Estuary SAC and a NERC Habitat of Principle Importance) and of functional importance for waterbirds, Notwithstanding that importance is considered to be high, taking all of these factors into account (including a negligible magnitude of change and no vulnerability to change), the potential effects arising from the direct loss of intertidal are considered to be **insignificant**.

[10] Based on the extents given in the Standard Data Form on the JNCC website (Ref 9-38)

Project impact assessment: Disposal

9.8.56 An assessment of the hydrodynamic and sediment regime changes that are predicted to occur as a result of the capital dredging disposal is presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**.

9.8.57 Local changes to the bathymetry (as a result of material disposal to the bed) within the disposal site will be small in the context of the existing depths. Disposal activity will be targeted to the deeper areas within the Site Boundary, ensuring that bed level changes are not excessive in any one area, thus, minimising the overall change. As a result, associated changes to the local hydrodynamics (and sediment transport pathways) will be negligible.

9.8.58 These changes are unlikely to result in any significant changes to local sediment transport in the region although some localised changes to seabed bathymetry and morphology could occur.

9.8.59 The predicted changes in flow rates and subtidal seabed morphology are not expected to modify existing subtidal habitat types found in the area (i.e. mobile sand habitats characterised by an impoverished infaunal assemblage).

9.8.60 Based on the available information provided above, magnitude of change on marine habitats and species from these highly localised and small scale predicted effects on the hydrodynamic and sedimentary processes is considered to be negligible. Although the probability of occurrence is high the overall exposure is assessed as negligible. The marine habitats which will be potentially affected are considered to be tolerant to the level of change in conditions expected and, therefore, sensitivity is assessed as low, and vulnerability is assessed as none. The benthic habitats and associated species that overlap with the changes brought about during disposal are of low ecological value but considered characteristic of the 'Sandbanks which are slightly covered by sea water all the time' feature of the Humber Estuary SAC. As a consequence, importance is assessed as moderate. The overall impact is, therefore, assessed as **insignificant**.

Changes in water and sediment quality during dredging and dredge disposal

General scientific context

Elevated suspended sediment concentrations

9.8.61 Dredging activities result in the suspension of disturbed sediment (Ref 9-162). Macrofauna living in estuarine systems which are subject to naturally high levels of SSCs are considered well adapted to living in highly turbid conditions. An increased level of suspended sediments may result in an increase in food availability and therefore growth and reproduction for surface deposit feeders (such as certain polychaetes) within estuarine environments that rely on a supply of nutrients at the sediment surface. However, food availability would only increase if the additional suspended sediment contained a significant proportion of organic matter, and the population would only be enhanced if food was previously limiting (Ref 9-146).

9.8.62 Greater energetic costs for benthic species could occur as a result of higher particle loads due to elevated suspended sediments stimulating the secretion of mucus to protect branchial or feeding structures of filter feeding organisms (Ref 9-163). Suspended sediment concentrations have been found to have a negative linear relationship with sub-surface light attenuation. Light availability and water turbidity are principal factors in determining depth range at which kelp and other algae are recorded. In addition, certain mobile epistrate feeders (such as the amphipod *Bathyporeia* spp.) feed on diatoms within the sand grains and an increase in suspended solids that consequently reduced light penetration could alter food supply (Ref 9-78). However, longer-term changes in turbidity levels rather than temporary elevations are likely to be required to elicit any measurable changes in these species.

9.8.63 Elevated suspended sediment levels can also cause increased scouring and damage of epifaunal species due to the potentially abrasive action of the suspended sediment in flowing water.

9.8.64 Increased suspended sediments may favour the development of suspension feeders such as bivalves over other species. However, it should be noted that many benthic invertebrates can switch feeding modes depending on environmental conditions. The negative effects of suspended sediment may be particularly important during larval settlement in spring, with settling stages potentially being more sensitive to effects such as scour. However, this is generally thought to be of less concern where fauna are adapted to naturally high levels of suspended sediments (Ref 9-164).

Dissolved oxygen

9.8.65 The resuspension of sediments containing organic material can cause oxygen depletion within the water column and the subsequent settling of this organic rich sediment can deplete sediment oxygen levels, potentially affecting benthic species. Reductions in dissolved oxygen from suspended sediments as a result of dredging are generally considered to be minimal and short-lived. However, potential effects can be more pronounced if dredging causes the disturbance of high levels of oxygen-depleting substances and nutrients present in some very fine-grained sediment deposits and where a great portion originate from waste water (Ref 9-165).

9.8.66 Oxygen depletion in severe situations can lead to hypoxia with most research on the effects of reductions in dissolved oxygen on benthic fauna during hypoxic conditions. This occurs when oxygen is consumed (e.g., by decomposing organic matter, respiration and oxidation of reduced chemical species) faster than it is replenished (e.g., via air-water oxygen transfer, photosynthesis, and mixing) (Ref 9-166). Coastal and estuarine waters can be particularly susceptible to low oxygen conditions as sediments are organic-rich and impose high sediment oxygen demands. Highly stratified estuaries, in which surface and bottom waters do not mix, are more prone to hypoxia (Ref 9-166). Coastal areas are more likely to experience hypoxia during summer when high temperatures strengthen salinity stratification (Ref 9-167). Severe anoxic events can deplete the benthic invertebrate communities and cause a shift in community composition, through attrition of intolerant species and elevated dominance, as well as reductions in

body size (Ref 9-168). In general, crustaceans and echinoderms are typically more sensitive to hypoxia, with lower oxygen thresholds, than annelids, molluscs and cnidarians (Ref 9-167).

Release of contaminants

9.8.67 Benthic habitats and species are sensitive to toxic contamination (where concentrations of contaminants exceed sensitivity thresholds). Toxic contamination during construction can occur as a result of the release of synthetic contaminants such as fuels and oils or through the resuspension of sediment as a result of the disturbance of the seabed which can lead to the release and mobilisation of sediment-bound contaminants into the water column. These include both toxic contaminants, such as heavy metals, pesticides and hydrocarbons, and non-toxic contaminants, such as nutrients. In particular, there is a risk that any uncontrolled releases of materials or sediments into the water column could make contaminants temporarily available for uptake by marine organisms. Over the longer-term any such releases could also become stored in the surface sediments of benthic habitats for future benthic uptake.

9.8.68 Suspension-feeding organisms may be particularly vulnerable to pollutants in the water column due to their dependence on filtration (Ref 9-78). High levels of chemical contaminants can potentially cause genetic, reproductive and morphological disorders in marine species. Contaminants may also have combined effects. Studies have suggested links between contamination with polycyclic aromatic hydrocarbons (“PAH”s), polychlorinated biphenyl (“PCB”s), amines and metals and a range of disorders (Ref 9-169). Increased incidence of tumours, neoplasia, DNA damage, polyploidy, hypoploidy, hermaphoditism and reduced immune response have all been reported in marine invertebrates in areas of high levels of pollution (Ref 9-170; Ref 9-171; Ref 9-172; Ref 9-173; Ref 9-174; Ref 9-175). Another highly researched pollutant is Tributyltin (“TBT”), which has toxic effects in a wide variety of biota, whereas inorganic tin is less toxic. TBT effects include lethal toxicity and effects on growth, reproduction, physiology, and behaviour. Several of the negative effects are due to interferences with the endocrine function, as occurs in the phenomenon imposex. Imposex is the superimposition of male organs onto females of gastropods, which are normally a dioecious species (Ref 9-176).

9.8.69 Sub-lethal effects of chemical contamination on marine invertebrates can reduce the fitness of individual species. Lethal effects may allow a shift in community composition to one dominated by pollution-tolerant species such as oligochaete worms (Ref 9-177). A reduction in community species richness is associated with elevated levels of pollutants. Contamination with PAHs, for example, leads to high levels of mortality in amphipod and shrimp species, and decreased benthic diversity (Ref 9-178). Similar reductions in diversity are linked with heavy metal contamination (Ref 9-179). Polychaete worms are thought to be quite tolerant of heavy metal contamination, whereas crustaceans and bivalves are considered to be intolerant (Ref 9-180).

Project impact assessment: Capital dredge

Elevated suspended sediment concentrations

9.8.70 The changes in SSC that are predicted to occur as a result of the capital dredge are presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**. In summary, the increased concentrations arising from the capital dredge will be of a lower magnitude and persist for a shorter distance (and time) than that from disposal activity which is summarised below.

9.8.71 Naturally very high SSC typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides (Ref 9-79; Ref 9-80). The estuarine benthic communities recorded on mudflats and the shallow mud in the region are considered tolerant to this highly turbid environment (Ref 9-74; Ref 9-75; Ref 9-76). The predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge and disposal activity (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**).

9.8.72 In summary, the predicted increases in SSC due to the capital dredging will be localised and temporary based on the Physical Processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**). Magnitude of change is assessed as negligible and probability of occurrence is high and thus the overall exposure to change is negligible. Based on the evidence provided above, sensitivity of benthic habitats and species within the vicinity of the Project to increases in suspended sediments are considered to be low given that these receptors are well adapted to living in high suspended sediment conditions. Vulnerability is therefore assessed as none. While subtidal benthic communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Importance is, therefore, considered to be moderate. The overall effect of suspended sediments on benthic habitats and species is assessed as **insignificant**.

Dissolved oxygen

9.8.73 With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a significant reduction in dissolved oxygen as assessed in the Water and Sediment Quality assessment in **Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**. The probability of a localised effect is, therefore, medium to high but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. On this basis the impact is assessed as **insignificant**.

Release of contaminants

9.8.74 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere. However, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into

suspension and remaining in the water column (i.e., through abrasion pressure from the draghead/bucket).

9.8.75 Sampling and subsequent chemical analysis has been undertaken in accordance with the agreed MMO sample plan. The results of this analysis are summarised in more detail in the Marine Water and Sediment Quality assessment (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**) and show the majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas Action Level 1 ("AL1"). There were no exceedances of Action level 2 ("AL2") in any sediment samples analysed.

9.8.76 Based on the chemical analysis, there are low levels of contamination in sediments in the proposed dredge area. Only a small proportion of disturbed material is expected to be raised into suspension and this material will be rapidly dispersed by strong tidal currents in the area. Significant elevations in the water column contamination are, therefore, not anticipated. Based on these factors, the magnitude of change to subtidal habitat and species will be negligible. Subsequently, exposure of benthic habitats and species to potential contaminants is also assessed as negligible. The sensitivity of subtidal habitats and species to contaminants is assessed as low to moderate because, although contaminants can cause toxicity, the concentrations of contaminants required to produce both lethal and sub-lethal effects are generally high (although responses vary considerably between species).

9.8.77 Thus, marine habitats and species are not considered to be vulnerable to water quality changes associated with the scale of the proposed dredge. Vulnerability is, therefore, assessed as none. While subtidal communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Importance is, therefore, considered to be moderate. Overall, the potential impact to benthic habitats and species arising as a result of disturbance of contaminated sediments is assessed as **insignificant**.

Project impact assessment: Disposal

Elevated suspended sediment concentrations

9.8.78 The changes in SSC that are predicted to occur as a result of the capital dredge disposal are presented in **Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**. In summary, the dredge disposal is predicted to produce peak SSC of around 600 to 800 mg/l above background at the disposal site, reducing to typically 100 to 200 mg/l within a distance of around 7km from the source. These peak increases are predicted to persist at any given location for a single modelled timestep (ten minutes) before the tidal forcing carries the plume further up or down estuary on the respective flood or ebb tide. SSCs of this magnitude are considered to regularly occur naturally or as a result of ongoing maintenance dredging/disposal. Upstream of Hull and downstream (within the outer estuary), maximum SSC levels are lower; generally, between 20 and 100 mg/l above background, as the tidal excursion from the disposal site limits the extent of the resultant plume. However, in reality due to the existing high SSC that typically occurs in the Humber Estuary, the predicted increase in

concentrations resulting from the disposal is likely to become immeasurable (against background) within approximately 1km of the disposal site. The measurable plume from each disposal operation is also only likely to persist for a single tidal cycle (less than six hours from disposal) as after this time the dispersion under the peak flood or ebb tidal flows means concentrations will have reverted to background levels.

9.8.79 Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded on mudflats and the shallow mud in the region are considered tolerant to this highly turbid environment (Ref 9-74; Ref 9-75; Ref 9-76). The predicted SSCs are within the range that can frequently occur naturally and also as a result of ongoing dredge and disposal activity (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**).

9.8.80 The disposal of sediment will temporarily increase SSC, however, due to the strong hydrodynamic conditions in the area, these temporary elevations in SSC are expected to dissipate rapidly to background concentrations. With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a significant reduction in dissolved oxygen nor therefore any implications for benthic species and habitats. The magnitude of change is therefore assessed as negligible. Probability of occurrence is high and thus the overall exposure to change is negligible. Sensitivity of benthic features within the disposal ground and surrounding area to increases in suspended sediments are considered to be low given that these species are well adapted to survival in conditions with elevated SSCs. Vulnerability is, therefore, assessed as none. The benthic habitats and associated species that overlap with the changes brought about during disposal are of low ecological value but considered characteristic of the ‘Sandbanks which are slightly covered by sea water all the time’ feature of the Humber Estuary SAC. Therefore, importance is assessed as moderate. The overall impact is, therefore, assessed as **insignificant**.

Release of contaminants

9.8.81 The results of the sediment contamination sampling are summarised above and the Water and Sediment Quality assessment (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**). In summary, low levels of contamination were found in the samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment.

9.8.82 During disposal, sediment will be rapidly dispersed in the water column. Therefore, the already low levels of contaminants in the dredged sediments will be dispersed further. The probability of changes in water quality occurring at the disposal site is considered to be low and the overall exposure to change is considered to be negligible. The sensitivity of subtidal habitats and species to contaminants is assessed as low to moderate because, although contaminants can cause toxicity in subtidal communities, the concentrations of contaminants required to produce both lethal and sub-lethal effects are generally high (although responses vary considerably between species). Thus, subtidal habitats and species are not considered to be vulnerable to water quality changes at the

disposal site in the context of the disposal of the dredged arisings. Vulnerability is, therefore, assessed as none. Benthic habitats and species that overlap with the dispersal plume are of low ecological value but considered characteristic of the 'Sandbanks which are slightly covered by sea water all the time' feature of the Humber Estuary SAC. As a consequence, importance is assessed as moderate. The overall impact is, therefore, assessed as **insignificant**.

Underwater noise and vibration effects on invertebrates during marine piling, capital dredging and dredge disposal

General scientific context

9.8.83 Marine invertebrates lack a gas-filled bladder and are thus unable to detect the pressure changes associated with sound waves (Ref 9-81). However, all cephalopods as well as some bivalves, echinoderms, and crustaceans have a sac-like structure called a statocyst which includes a mineralised mass (statolith) and associated sensory hairs. Statocysts develop during the larval stage and may allow an organism to detect the particle motion associated with soundwaves in water to orient itself. In addition to statocysts, cephalopods have epidermal hair cells which help them to detect particle motion in their immediate vicinity, comparable to lateral lines in fish. Similarly, decapods have sensory setae on their body, including on their antennae which may be used to detect low-frequency vibrations. Whole body vibrations due to particle motion have been detected in cuttlefish and scallops, although species names and details of associated behavioural responses are not specified.

9.8.84 Scientific understanding of the potential effects of underwater noise on marine invertebrates is relatively underdeveloped (Ref 9-103). There is limited research to suggest that exposure to near-field low-frequency sound may cause anatomical damage (Ref 9-81). Anecdotal evidence indicates there was pronounced statocyst and organ damage in seven stranded giant squid after nearby seismic surveys (Ref 9-130). Airgun exposure can cause damaged statocysts in rock lobsters up to a year later (Ref 9-82). However, no such effects were detected in other studies (Ref 9-83). The disparate results between studies seem to be due to differences in sound exposure levels and duration, in some cases due to tank interference, although taxa-specific differences in physical vulnerability to acoustic stress cannot be discounted (Ref 9-81).

9.8.85 There is also increasing evidence to suggest that benthic invertebrates behaviourally respond to particle motion (vibration) (Ref 9-84). For example, blue mussels *Mytilus edulis* vary valve gape, oxygen demand and clearance rates (Ref 9-85) and hermit crabs *Pagurus bernhardus* shift their shell and at very high amplitudes, leave their shell, examine it and then return (Ref 9-84). The vibration levels at which these responses were observed generally correspond to levels measured near anthropogenic operations such as pile driving and up to 300m from explosives testing (blasting). A range of behavioural effects have also been recorded in decapod crustaceans, including a change in locomotion activity, reduction in antipredator behaviour and change in foraging habits (Ref 9-86). However, population level and mortality effects are considered unlikely.

Project impact assessment: Marine piling

9.8.86 Based on the evidence provided in the above scientific context review of the potential effects of underwater noise, population level and mortality effects in benthic invertebrates are considered unlikely. The Project will involve the installation of approximately up to 393 steel tubular piles of varying size in the marine environment. Further details are provided in **Chapter 2: The Project [TR030008/APP/6.2]**. The marine piling works will be temporary and are anticipated to be completed within 343 days.

9.8.87 Applying the project impact assessment methodology, the probability of a change in underwater noise and vibration occurring during marine piling is considered to be high. However, the marine piling activities will be temporary, lasting a period of 343 days, with the vibro and percussive (impact) marine piling noise only taking place for up to a maximum of 60 minutes and 270 minutes per day respectively over that period. Based on these factors, magnitude of the change in underwater noise and vibration due to marine piling is considered to be negligible. Population level and mortality effects in benthic invertebrates are considered unlikely but the marine piling may result in short term behavioural responses in some individuals. The sensitivity of the benthic invertebrate species to marine piling is, therefore, considered to be low. While both the subtidal and intertidal benthic communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Intertidal habitats are protected (both a qualifying feature of the Humber Estuary SAC and a NERC Habitat of Principle Importance) and of functional importance for waterbirds. Importance is, therefore, considered to range from moderate (for subtidal habitats) to high (for intertidal habitats). On this basis, given that the magnitude of change is negligible and the sensitivity of benthic invertebrates is low, although the importance of benthic habitats ranges from moderate to high, the impact of marine piling noise and vibration on benthic invertebrates is assessed as **insignificant.**

Project impact assessment: Capital dredge and disposal

9.8.88 Based on the above review of the potential effects of underwater noise, population level and mortality effects in benthic invertebrates are considered unlikely. Furthermore, dredging is known to produce lower noise levels than marine piling or blasting and therefore, there is unlikely to be significant effects on benthic invertebrates.

9.8.89 Based on the evidence provided above in the scientific review and applying the project impact assessment methodology, the probability of a change in underwater noise and vibration occurring during dredging and disposal is considered to be high. However, dredging and the movement of vessels associated with disposal activities are known to produce lower noise levels than marine piling. Furthermore, the proposed capital dredge and disposal activities will be short term and temporary, lasting a period of around 12 days in total. Population level and mortality effects in benthic invertebrates is, therefore, considered unlikely and the only effect that could be expected in the vicinity of the dredging would be short term behavioural responses. Based on these factors, the magnitude of the change in underwater noise and vibration due to dredging

and disposal is considered to be negligible. The sensitivity of the benthic invertebrate species to dredging and disposal noise is considered to be low. As noted earlier, however, their overall importance is considered to range from moderate to high. On this basis, the impact of dredging and disposal noise and vibration on benthic invertebrates is assessed as **insignificant**.

The potential introduction and spread of non-native species

General scientific context

9.8.90 Non-native, or invasive, species are described as 'organisms introduced into places outside of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem and species' (International Union for Conservation of Nature (Ref 9-87). The ecological impacts of such 'biological invasions' are considered to be the second largest threat to biodiversity worldwide, after habitat loss and destruction. In the last few decades marine and freshwater systems have been impacted by invasive species, largely as a result of increased global shipping (Ref 9-88).

9.8.91 The introduction and spread of non-native species can occur either accidentally or by intentional movement of species as a consequence of human activity (Ref 9-89 cited in Ref 9-90). The main pathway for the potential introduction of non-native species is via fouling of vessels' hulls, transport of species in ballast or bilge water and the accidental imports from materials brought into the system during development activities. Pathways involving vessel movements (fouling of hulls and ballast water) have been identified as the highest potential risk routes for the introduction of non-native species (Ref 9-91; Ref 9-84), particularly from different biogeographical regions, which agrees with the fact that areas with a high volume of shipping traffic are hotspots for non-native species in British waters (Ref 9-84).

9.8.92 The fouling of a vessel hull and other below-water surfaces can be reduced through the use of protective coatings. These coatings usually contain a toxic chemical (such as copper) or an irritant (such as pepper) that discourages organisms from attaching. Other coatings, such as those that are silicone-based, provide a surface that is more difficult to adhere to firmly, making cleaning of the hull less laborious. The type and concentration of coatings that can be applied to a boat hull is regulated and can vary between countries. Maintenance of hulls through regular cleaning will minimise the number of fouling organisms present. Hull cleaning can take place on land or in-water. In both cases, care needs to be taken to prevent the organisms and coating particles from being released into the water. By following best management practices, the impact of the cleaning procedure on the environment can be minimised.

9.8.93 Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into tanks when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances. In 2004, the International Maritime Organisation ("IMO") adopted the 'International Convention for the Control and Management of Ships' Ballast Water and Sediments', which introduced two performance standards seeking to limit the risk of non-native

invasive species being imported (including distances for ballast water exchange and standards for ballast water treatment). The Convention came into force internationally in September 2017.

9.8.94 The UK is bound by international agreements such as the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979), the Convention on the Conservation of European Wildlife and Natural Habitat (Berne Convention, 1979) and the Habitats and Birds Directives. All of these include provisions requiring measures to prevent the introduction of, or control of, non-native species, especially those that threaten native or protected species (Ref 9-92). Additionally, Section 14(1) of the WCA makes it illegal to release, or allow to escape into the wild, any animal which is not ordinarily resident in Great Britain and is not a regular visitor to Great Britain in a wild state or is listed in Schedule 9 to the WCA.

Project impact assessment

9.8.95 As discussed above, non-native species have the potential to be transported into the study area on ships' hulls during capital dredging and construction activity (such as crane barges used in marine piling). Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into the dredger tanks or hopper when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances.

9.8.96 Within England and Wales, best practice guidance has been developed on how to manage marine biosecurity risks at sites and when undertaking activities through the preparation and implementation of biosecurity plans (Ref 9-93).

9.8.97 This guidance will be followed when developing biosecurity control measures to minimise the risk of the introduction and spread of non-native species during construction of the Project. These measures will be included within the **Outline CEMP [TR030008/APP/6.5]**. On this basis, the probability of the introduction and spread of non-native species from the construction phase is considered to be low. However, given that the magnitude of change is unknown, magnitude ranges from negligible to large depending upon the scale and nature of any non-native species introduction, thus the exposure ranges from negligible to low at worst. The sensitivity of all intertidal and subtidal receptors to non-native species introductions is expected to range from low to moderate. Vulnerability is, therefore, considered to be low. In addition, importance is considered to range from high (for intertidal mudflats) to moderate (for subtidal habitats). The overall impact is, therefore, considered to be **insignificant** to **minor adverse.**

Fish

9.8.98 This section contains an assessment of the potential impacts to fish receptors as a result of the construction phase of the Project. An assessment of the following impact pathways has been undertaken:

i. Direct loss or changes to fish populations and habitat as a direct result of dredging and dredge disposal.

j. Changes in water and sediment quality as a result of dredging and dredge disposal.

k. Underwater noise and vibration during marine piling, capital dredging and dredge disposal.

Direct loss or changes to fish populations and habitat as a direct result of dredging and dredge disposal

General scientific context

Indirect effects (food chain)

9.8.99 Seabed sediment removal during dredging has the potential to directly impact demersal fish but, more importantly, could also impact upon the benthic communities that are prey for fish and shellfish, and consequently could alter the distribution and presence of fish species in the region. Fish can have different feeding strategies, for example, some demersal feeders such as cod can show a strong preference for crustacea (Ref 9-181), whereas species such as plaice, dover sole, lemon sole and dab are benthic invertebrate feeders with a strong preference for polychaetes. Other species such as sand eel and whiting are invertebrate and piscivorous feeders. However, a change in dietary composition as a result of dredging is not considered to be damaging to the fish population as the majority of species are likely to switch to alternate prey sources in the event of an impact on their preferred prey, providing sufficient biomass is available to support them (Ref 9-181).

Indirect effects (habitat change)

9.8.100 Should the removal of seabed sediments during dredging lead to habitat loss or change, it could potentially impact on key habitats including feeding, spawning, nursery and overwintering grounds that have an important ecological function (Ref 9-131). Fish species that spawn directly onto the seabed are more sensitive to the effects of seabed removal due to dredging than those that spawn into the water column. For example, herring use coarse sediments as spawning grounds. Herring along with sand eel species which live within the sediment are considered particularly sensitive to habitat change (Ref 9-145).

Direct effects (uptake)

9.8.101 Hydraulic entrainment, through the direct uptake of aquatic organisms by the suction field generated at the draghead or cutterhead during dredging operations has the potential to result in the by-catch of fish eggs, larvae and even mobile juveniles and adults (Ref 9-95).

9.8.102 Limited research has been carried out regarding entrainment rates of fish in marine dredging. Lees *et al*. (Ref 9-182) sampled the outwash from an aggregate dredger in the English Channel and recorded the species. In five x ten minute samples, 22 fish were sampled and a further red gurnard was found from the surface of the hopper cargo. Most fish appeared physically undamaged and would have been washed back to sea, however the scope of the study did not include assessments of their subsequent survival rates. Demersal fish with poorer hearing sensitivity including flatfish and elasmobranchs are considered

more likely to be entrained by the dredger drag head (Ref 9-183; Ref 9-184). Large and active demersal and pelagic juvenile and adult finfish are likely to avoid dredging areas during operations in response to noise levels and increased turbidity (Ref 9-145).

9.8.103 In general, eggs, embryo and larval stages are considered more vulnerable to entrainment than adults. While the entrainment rates are likely to represent a small proportion of total larval production, fish entrained at the egg, embryo and larval stages will experience extremely high mortality rates although mortality rates will vary among fish species and development stages (Ref 9-95).

Project impact assessment: Capital dredge

9.8.104 Habitat change could potentially impact on critical habitats including spawning, nursery and feeding grounds that have an important ecological function for fish. However, the dredge footprint is considered unlikely to provide important nursery or spawning functions for fish species as a result of the existing disturbed nature of this habitat despite known nursery or spawning areas for species such as Dover sole, whiting or cod occurring in the wider Humber Estuary area.

9.8.105 Potential prey items for flatfish and demersal fish such as polychaete worms were recorded during the project specific subtidal surveys (**Appendix 9.A [TR030008/APP/6.4]**) (Ref 9-77). However, most fish species are opportunistic and generalist feeders, which means that they are generally not reliant on a single prey item. Fish are also mobile species and will easily be able to move away from the zone of influence and utilise other nearby areas for foraging. Furthermore, the area of habitat change will only represent a small proportion of the foraging ranges of many fish species (particularly the larger and more commercial species such as whiting, plaice and Dover sole).

9.8.106 During dredging, there is the potential for fish along with roe (eggs) of these species to be removed. The region is known to support Dover sole spawning grounds. Dover sole spawn on a range of substrates in shallow water. However, the dredge footprint and nearby area is already subject to regular natural seabed disturbance due to strong tidal currents. The dredge footprint and nearby area is, therefore, likely to provide disturbed and sub-optimal spawning conditions with more optimal habitat present in the wider region. In addition, the dredge footprint is considered negligible in the context of suitable nursery habitat in the region.

9.8.107 Given the very small dredge footprint in the context of the entire Humber Estuary (and small amount of material that needs to be dredged), the probability that diadromous species such as European eel and lamprey species will be removed into the bucket during backhoe dredging while passing through the estuary on migration is considered to be relatively low.

9.8.108 Based on these factors, magnitude is considered to be small and probability medium. Consequently, the exposure of all fish to direct habitat changes is considered to be negligible to low. The sensitivity of fish to habitat change on the scale predicted is considered to be low, leading to a low vulnerability. Therefore, while the overall importance of certain fish species is high (i.e. for fish species of conservation interest), the impact is assessed as **insignificant** to **minor adverse**.

Project impact assessment: Disposal

9.8.109 The disposal of dredged material at the marine disposal sites will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats.

9.8.110 The disposal grounds are located in a highly dynamic area with the mobile sandbanks subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows and deposition due to regular dredge activity. This is reflected in a highly impoverished assemblage at both disposal sites (characterised by a few opportunistic species in very low numbers). This area is, therefore, likely to provide limited prey resources for fish species. In addition, as described above, benthic infaunal species characterising the disposal site are considered likely to show some tolerance to sediment deposition and also rapid recoverability rates. On this basis, potential effects on prey resources for fish are expected to be of low magnitude and temporary. Fish are also mobile species and will easily be able to move away from the zone of influence and return following the cessation of disposal activity.

9.8.111 The highly disturbed nature of the seabed is also unlikely to provide suitable conditions as a spawning or nursery area for fish.

9.8.112 Based on these factors, magnitude is considered to be small and probability medium. Consequently, the exposure of all fish to direct habitat changes is considered to be negligible to low. The sensitivity of fish to habitat change on the scale predicted is considered to be low, leading to a low vulnerability. Therefore, while the overall importance of certain fish species is high (i.e. for fish species of conservation interest), the impact is assessed as **insignificant** to **minor adverse**.

Changes in water and sediment quality as a result of dredging and dredge disposal

General scientific context

Elevated suspended sediment concentrations

9.8.113 Increased suspended sediments can lead to physiological effects in adult finfish resulting from the abrasion of sediment particles on gill tissues, causing reduced gill function and possible mortality (Ref 9-95; Ref 9-96; Ref 9-134). Such effects on fish are considered to occur at suspended sediment levels of around 10,000 mg/l (Ref 9-185). High SSC levels may impact spawning and nursery grounds through damage to eggs and planktonic larvae, as well as causing abrasion or clogging of the fragile gills of larval and juvenile fish, resulting in mortality or reduced growth rates.

9.8.114 Because turbidity often impairs visual acuity, activities and processes that require vision can be inhibited, leading to behavioural responses. For example, foraging in both planktivorous and piscivorous fish can be negatively affected by suspended sediments. Piscivores are especially sensitive to increasing turbidity because many are visual hunters that detect prey from a distance. An increase in suspended sediment reduces both light and contrast, decreasing encounter distances between predator and prey (Ref 9-95).

9.8.115 Elevated suspended sediments can also influence the movements and migration of fish (Ref 9-134). For example, a range of salmonid species have been observed actively avoiding moving through areas with suspended sediment plumes (Ref 9-95; Ref 9-96). However, such responses can cease if fish become acclimatised. Fish in high latitude coastal areas typically have to contend with variable turbidity and often poor visual conditions, resulting from fluctuations in ambient light levels, suspended sediments and in the light transmission properties of the water (Ref 9-134). For example, concentrations as high as 9,000 mg/l have been recorded in the path of salmon runs in the Usk Estuary (Ref 9-186). Similarly, lamprey and shad species have been known to successfully pass through estuaries with extremely high suspended sediments and, therefore, can be considered tolerant of turbid conditions (Ref 9-187). The mobile nature of fish species generally allows avoidance of areas of adverse conditions which are unlikely to significantly affect a population provided such conditions are temporary.

Organic enrichment and oxygen depletion

9.8.116 The resuspension of sediments containing organic material can cause oxygen depletion within the water column. The subsequent settling of this organic rich sediment can deplete the sediments of oxygen and affect benthic prey items used by fish. The response of fish to low concentrations of dissolved oxygen is determined by a range of factors, including the duration of exposure, water temperature and the presence of other pollutants (Ref 9-95). The duration of any low dissolved oxygen event is a key factor in determining its effect. Most fish would survive an extremely low concentration of dissolved oxygen, such as 2 mg/l, for a few minutes, but a longer exposure would start to have sub-lethal and eventually lethal effects (Ref 9-188).

Release of contaminants

9.8.117 The potential release of contaminants during construction and dredging activities may result in those contaminants becoming available for uptake by any fish in the water column or on surface sediments. There is an indirect risk to some finfish species as sediment-bound contaminants may temporarily bioaccumulate in the tissues of certain fish prey, such as polychaete worms and marine bivalves, and made available for uptake by feeding fish (Ref 9-134).

9.8.118 The influence of contaminated sediments is considered to have a greater impact on fish than elevated SSC with a range of evidence suggesting that direct exposure to contaminants negatively effects fish (Ref 9-95). Hydrophobic contaminants (such as legacy persistent organic pollutants including PCBs and organochlorine pesticides) as well as high-molecular weight polyaromatic and aliphatic hydrocarbons (such as PAHs), are closely associated with organic material in sediments. These contaminants have been linked to a range of potential reproductive impacts on adult fish (e.g. steroidogenesis, vitellogenesis, gamete production or spawning success) as well as lethal and non-lethal developmental (spinal and organ development, growth) impacts on embryos and larvae (Ref 9-189).

9.8.119 Demersal fish species, such as dab and flounder, which remain close to the seabed and feed mainly on benthic organisms, would experience a higher exposure to contaminated sediments than pelagic fish such as herring.

Project impact assessment: Capital dredge

9.8.120 The changes in SSC that could potentially occur as a result of the capital dredge are presented in the Physical Processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**) and summarised above in the 'Benthic habitats and species' sub-section (**Paragraphs 9.8.70** to **9.8.72**).

9.8.121 As noted in the preceding section, fish within the Humber Estuary are well adapted to living in an area with variable and typically very high suspended sediment loads. Fish feed on a range of food items and, therefore, their sensitivity to a temporary change in the availability of a particular food resource is considered to be low. Their high mobility enables them to move freely to avoid areas of adverse conditions and to use other food sources in the local area.

9.8.122 As highlighted above, salmonids and other migratory fish can be sensitive to elevated SSC. However, Atlantic salmon and sea trout are both known to migrate through estuaries with high SSC to get to spawning areas (including the Humber Estuary which is considered one of the estuaries in the UK with the highest levels of SSCs) (Ref 9-94; Ref 9-95; Ref 9-96; Ref 9-79; Ref 9-80; Ref 9-134). Other migratory species such as lamprey and shad species also pass through estuaries with high suspended sediments. Elevated SSCs due to dredging are expected to be of a magnitude that can occur naturally during migratory periods or as a result of ongoing maintenance dredging/disposal.

9.8.123 Sediment plumes resulting from dredging will be relatively localised (in the context of the entire width of the estuary). It is considered that they will dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time (less than a single tidal cycle) as described in more detail in the Physical Processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**). Therefore, salmonids and other migratory fish will also be able to avoid the temporary sediment plumes. Based on these factors there is considered to be limited potential for migrating fish to be adversely affected by the predicted changes in SSC.

9.8.124 Given that elevated SSCs due to dredge and dredge disposal are considered to be in the range of variability that can occur naturally in the Humber Estuary (which has very high SSCs year-round, particularly during the winter months) as well as due to ongoing maintenance dredging/disposal and that plumes will be temporary in nature, sensitive life stages of fish occurring in the region such as larvae and juvenile fish are considered unlikely to be adversely affected by the dredging.

9.8.125 Whilst, therefore, the probability of a localised and temporary change is high, the magnitude of change will be negligible and consequently exposure to change is assessed as negligible. Sensitivity of fish is assessed as low to moderate and consequently vulnerability is assessed as none. It follows that although the overall importance of certain fish species is high (i.e. for fish species of conservation interest), the impact is assessed as **insignificant**.

9.8.126 With respect to dissolved oxygen, increases in SSC will be brief and localised and there is not expected to be a significant reduction in dissolved oxygen as assessed in the Water and Sediment Quality assessment (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**). The probability of a localised effect is, therefore, medium to high but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Whilst the sensitivity of fish is considered to be low to moderate and certain species have a high nature conservation importance, the impact is assessed as **insignificant.**

9.8.127 With respect to sediment contamination, generally low levels of contamination were found in the sediment contamination samples as presented in the Water and Sediment Quality assessment (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**).

9.8.128 Based on this sampling data, the overall level of contamination in the proposed dredge area is considered to be low and the sediment plume would be expected to rapidly dissipate by the strong tidal currents in the area. Significant elevations in the concentrations of contaminants within the water column are not anticipated. Based on these factors, therefore, the magnitude of change to fish species is considered to be negligible. Subsequently, exposure of fish species to potential contaminants is assessed as negligible. Given that the sensitivity of fish is considered to be low to moderate and the overall importance is considered to range from low to high, depending on the ecological value and protected status of individual species, the impact is assessed as **insignificant.**

Project impact assessment: Dredge disposal

9.8.129 The changes in SSC that could potentially occur as a result of the disposal activities are presented in the Physical Processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**) and summarised above in the 'Benthic Habitats and Species' impact assessment sub-section (**Paragraphs 9.8.78** to **9.8.79**).

9.8.130 The disposal of sediment will temporarily increase SSC, however, due to the strong hydrodynamic conditions in the area, these temporary elevations in SSC are expected to rapidly dissipate to background concentrations within a matter of hours and before the next disposal. As highlighted above, migratory species including Atlantic salmon are known to migrate through estuaries with high SSC (including the Humber Estuary which is considered one of the estuaries in the UK with the highest levels of SSC) (Ref 9-79) and the predicted SSC are within the range that can frequently occur naturally during migratory periods and also as a result of ongoing dredge and disposal activity. Sediment plumes resulting from disposal will also be relatively localised in the context of the entire width of the estuary. Therefore, salmonids and other migratory fish would also be able to avoid the temporary sediment plumes.

9.8.131 Based on these factors, the magnitude of change is assessed as negligible and probability of occurrence is high and thus the overall exposure to change is negligible. Therefore, while the sensitivity of fish is low to moderate and certain species have a high nature conservation importance (e.g. migratory Atlantic salmon and lamprey) any impact is assessed as **insignificant**.

9.8.132 With respect to sediment contamination, the results of the sediment contamination sampling are summarised above, and in the Water and Sediment Quality chapter (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**). In summary, generally low levels of contamination were found in the samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment.

9.8.133 Based on the results of the sediment sampling survey, the overall level of contamination in the proposed dredge area is considered to be low. During disposal, sediment will be rapidly dispersed in the water column. As a consequence, the already low levels of contaminants in the dredged sediments will be dispersed further. The probability of changes in water quality occurring at the disposal site is considered to be low and the overall exposure to change is considered to be negligible. Whilst, therefore, the sensitivity of fish is low to moderate and certain species have a high nature conservation importance, any impact will be **insignificant**.

Underwater noise and vibration during marine piling, capital dredging and dredge disposal

General scientific context

9.8.134 Elevated underwater noise and vibration levels during construction activities can potentially disturb fish by causing physiological damage and/or inducing adverse behavioural reactions. A detailed underwater noise assessment has been undertaken for the Project (**Appendix 9.B [TR030008/APP/6.4]**) and is briefly summarised in this section.

9.8.135 For most marine piling activities, the main source of noise and vibration relates to where piles are hammered or vibrated into the ground. Percussive marine piling involves hammering the pile into the seabed resulting in an impact blow and high levels of noise. Vibro marine piling produces lower levels of noise as piles are vibrated into the seabed.

9.8.136 The dredging process involves a variety of sound generating activities which can be broadly divided into sediment excavation, transport and placement of the dredged material at the disposal site (Ref 9-97; Ref 9-98; Ref 9-99). For most dredging activities, the main source of sound relates to the vessel engine noise.

9.8.137 There is a wide diversity in hearing structures in fish which leads to different auditory capabilities across species (Ref 9-100). All fish can sense the particle motion[11] component of an acoustic field via the inner ear as a result of whole-body accelerations (Ref 9-101), and noise detection ('hearing') becomes more specialised with the addition of further hearing structures. Particle motion is especially important for locating sound sources through directional hearing (Ref 9-102; Ref 9-103; Ref 9-104). Although many fish are also likely to detect sound pressure[12], particle motion is considered equally or potentially more important (Ref 9-105).

9.8.138 From the few studies of hearing capabilities in fish that have been conducted, it is evident that there are potentially substantial differences in auditory capabilities from one fish species to another (Ref 9-105). Popper *et al* (2014) proposed the following three categories of fish which are described below (Ref 9-102):

l. Fish with a swim bladder or air cavities that aid hearing.

m. Fish with a swim bladder that does not aid hearing.

n. Fish with no swim bladder.

9.8.139 The first category comprises fish that have special structures mechanically linking the swim bladder to the ear. Fish species in the study area that fall within this first category include herring (*Clupea harengus*) and shads.

9.8.140 The second category comprises fish with a swim bladder where the organ does not appear to play a role in hearing. Fish species in the study area that fall within this second category include Atlantic cod (*Gadus morhua*), Atlantic salmon (*Salmo salar*), European eel (*Anguilla anguilla*), European seabass (*Dicentrarchus labrax*), Atlantic mackerel (*Scomber scombrus*), smelt (*Osmerus eperlanus*) and whiting (*Merlangius merlangus*).

9.8.141 The third category comprises fish lacking swim bladders that are sensitive only to sound particle motion and show sensitivity to only a narrow band of frequencies (e.g. flatfishes, sharks, skates and rays). Fish species in the study area that fall within this third category include plaice (*Pleuronectes platessa*), sea lamprey (*Petromyzon marinus*), sole (*Solea solea*) and thornback ray (*Raja clavata*).

Project impact assessment: Marine piling

9.8.142 The distances at which mortality and potential mortal injury, recoverable injury, temporary threshold shift ("TTS") and behavioural effects in fish are predicted to occur as a result of the percussive marine piling and vibro marine piling associated with the development are included in **Appendix 9.B [TR030008/APP/6.4]**.

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11 Particle motion is a back and forth motion of the medium in a particular direction; it is a vector quantity that can only be fully described by specifying both the magnitude and direction of the motion, as well as its magnitude, temporal, and frequency characteristics.

12 Pressure fluctuations in the medium above and below the local hydrostatic pressure; it acts in all directions and is a scalar quantity that can be described in terms of its magnitude and its temporal and frequency characteristics.

9.8.143 The Project will involve the installation of piles of varying sizes. The highest peak noise levels are generally associated with larger-sized piles given the larger surface area of the pile in contact with the water and the larger hammer energy and/or pile driving time involved in driving them. On this project, the largest piles are up to 2.3m in diameter. However, given that only a total of two of these piles will be driven for the Project, they only represent a very small proportion of all the piles (< 1 %). In addition to modelling the propagation of noise associated with these larger 2.3 m diameter piles as a worst case, therefore, the propagation of noise associated with the second largest 1.5m diameter piles, which comprise a more significant proportion of all the piles (45 %), has also been modelled.

9.8.144 The predicted range at which the quantitative instantaneous peak Sound Pressure Level ("SPL") thresholds for pile driving are reached (as defined in Ref 9-102) indicates that for the 2.3m diameter piles, there is a risk of mortality, potential mortal injury or recoverable injury within 80m from the source of impact marine piling in fish with a swim bladder (such as herring, Atlantic salmon and European eel) and within 40m in fish with no swim bladder (such as lamprey and flatfish). For 1.5m diameter piles, there is a risk of mortality, potential mortal injury or recoverable injury within 20m from the source of impact marine piling in fish with a swim bladder (such as herring, Atlantic salmon and European eel) and within 10m in fish with no swim bladder (such as lamprey and flatfish).

9.8.145 The calculator developed by the United States National Marine Fisheries Service ("NMFS") (Ref 9-106) as a tool for assessing the potential effects to fish exposed to elevated levels of underwater sound produced during pile driving was used to calculate the range at which the cumulative Sound Exposure Levels ("SEL") thresholds for pile driving (Ref 9-102) are reached. Based on the assumptions highlighted in **Appendix 9.B [TR030008/APP/6.4]**, for the 2.3m diameter piles, there is predicted to be a risk of mortality and potential mortal injury within 200m from the source of impact marine piling in fish with a swim bladder involved in hearing (such as herring), within 100m from the source in fish with a swim bladder not involved in hearing (such as European eel) and within 40m in fish with no swim bladder (such as sole). For 1.5m diameter piles, there is predicted to be a risk of mortality and potential mortal injury within 60m from the source of impact marine piling in fish with a swim bladder involved in hearing (such as herring), within 40m from the source in fish with a swim bladder not involved in hearing (such as European eel) and within 10m in fish with no swim bladder (such as sole). For the 2.3m diameter piles, the distance at which the received level of impact marine piling noise is within the limits of the recoverable injury threshold is within 300m in fish with a swim bladder and 60m in fish without a swim bladder. For 1.5m diameter piles, the distance at which the received level of noise is within the limits of the recoverable injury threshold is within 100m in fish with a swim bladder and 20m in fish without a swim bladder.

9.8.146 For vibro marine piling of either 2.3m or 1.5m diameter piles, there is predicted to be a risk of mortality and potential mortal injury within 50m from the source in fish with a swim bladder involved in hearing, within 30m from the source in fish with a swim bladder not involved in hearing and within 10m in fish with no swim bladder. The distance at which the received level of noise is within the limits of the recoverable injury threshold is within 80m in fish with a swim bladder and 10m in fish without a swim bladder.

9.8.147 Given the mobility of fish, any individuals that might be present within the localised areas associated with potential mortality/injury during pile driving activities would be expected to easily move away and avoid harm. Furthermore, the area local to the Project is not considered a key foraging, spawning or nursery habitat for fish and, therefore, this localised zone of injury is unlikely to result in any significant effects on fish.

9.8.148 The range at which the Ref 9-102 TTS and Ref 9-107 quantitative instantaneous peak SPL behaviour thresholds for percussive pile driving are reached indicates that there is a risk of a behavioural response in fish within around 2-3km from the source of impact marine piling for 2.3m diameter piles and 1-2 m from the source of impact marine piling 1.5m diameter piles. For the 2.3m diameter piles, TTS and behavioural reactions during impact marine piling are, therefore, anticipated to occur across 87% to 100% width of the Humber Estuary at low water and 59 % to 88 % of the width of the estuary at high water. For the 1.5m diameter piles, TTS and behavioural reactions are anticipated to occur across 43% to 87% of the width of the Humber Estuary at low water and 29% to 59% of the estuary width at high water. Impact marine piling, therefore, has the potential to create a partial to full temporary barrier to fish movements. For vibro marine piling, there is a risk of TTS and behavioural reactions in fish within around 1km from the source which equates to 43% of the width of the Humber Estuary at low water respectively and 29% of the estuary width at high water.

9.8.149 The scale of the behavioural response is partly dependent on the hearing sensitivity of the species. The key fish in the study area include species across the range of Ref 9-102 fish hearing groups. Fish with a swim bladder involved in hearing (e.g. herring) may exhibit a moderate behavioural reaction within a distance in which a behavioural response is predicted (e.g. a sudden change in swimming direction, speed or depth). Fish with a swim bladder that is not involved in hearing (e.g. European eel) are likely to display a milder behavioural reaction. Fish without a swim bladder (e.g. river lamprey) are likely to show only very subtle changes in behaviour in this zone.

9.8.150 The scale of the behavioural effect is also dependent on the size of fish (which affects maximum swimming speed). Smaller fish, juveniles and fish larvae swim at slower speeds and are likely to move passively with the prevailing current. Larger fish are more likely to actively swim and, therefore, may be able to move out of the behavioural effects zone in less time, although it is recognised that the movement of fish is very complex and not possible to define with a high degree of certainty.

9.8.151 The effects of marine piling noise on fish also need to be considered in terms of the duration of exposure. Marine piling noise will take place over a period of approximately 343 days. However, marine piling will not take place continuously as there will be periods of downtime, pile positioning and set up.

9.8.152 The marine piling works will be undertaken seven days per week. Intended working hours will be from 07:00 to 19:00 in winter months (1 September to 31 March inclusive) and sunrise to sunset in the summer months (1 April to 31 August inclusive). The maximum impact marine piling scenario is for three tubular piles to be installed each day using up to two marine piling rigs pile driving at any one time, involving approximately 270 minutes of impact (percussive) marine piling per day and 60 minutes of vibro marine piling per day in a 12-hour shift. There will, therefore, be significant periods over a 24-hour period when fish will not be disturbed by any marine piling noise. The actual proportion of marine piling is estimated to be at worst around 23% over a 24-hour period (based on 270 minutes of impact marine piling and 60 minutes of vibro marine piling each working day) over any given construction week. In other words, any fish that remain within the predicted behavioural effects zone at the time of marine piling will not be exposed up to 77% of the time over the period of a day.

9.8.153 The marine piling will occur between 07:00 to 19:00 in the winter months and sunrise to sunset in the summer months, which has the potential to disproportionately affect fish that migrate during daylight hours, whilst reducing the potential exposure of fish that predominantly migrate during night time hours (e.g., river lamprey and glass eel).

9.8.154 It is also important to consider the noise from marine piling against existing background or ambient noise conditions. The levels of underwater noise generated by impact marine piling are predicted to reach existing background levels previously measured in the Humber Estuary within around 2 to 3km from the source. The levels of underwater noise generated by vibro marine piling are predicted to reach background levels within around 1km from the source. Furthermore, the wider local area in which the construction will take place already experiences regular vessel operations and ongoing maintenance dredging, and, therefore, fish are likely to be habituated to a certain level of anthropogenic background noise.

9.8.155 Applying the standard impact assessment criteria, the probability of occurrence of underwater noise disturbance during marine piling is high. Given the uncertainty regarding the actual timing and programme for the marine piling, this assessment has been undertaken on the basis that the works could take place at any time of year as a worst case. There is the potential for marine piling to occur during the sensitive migratory periods of fish in the Humber Estuary, including the migratory periods of diadromous fish such as Atlantic salmon, European smelt, European eel, shads and lamprey. Migratory fish moving between the Humber Estuary and the sea could potentially pass near to the proposed marine works (with a risk of injury potentially occurring in very close proximity to the marine piling activity). In addition, a behavioural response (e.g., displacement) or acoustic barrier could occur over the majority of the width of the Humber Estuary at low water and a slightly smaller proportion of the estuary width at high water. Magnitude and

consequently exposure to change is, therefore, considered to be medium for these migratory species.

9.8.156 The sensitivity of Atlantic salmon, sea trout, European smelt, shads and European eel is considered to be moderate with the sensitivity of lamprey species low based on the Popper *et al*. (Ref 9-102) fish noise exposure criteria. All diadromous fish species are considered to have a high importance due to their conservation value and protection. On this basis, whilst only temporary and short term in duration, the effect on Atlantic salmon, sea trout, European smelt, shads, European eel is considered to be **moderate adverse** and the effect to lamprey species **minor adverse**.

9.8.157 In terms of other fish occurring in the Humber Estuary, the effect is considered to be **insignificant to minor adverse**. This is based on these other fish having a range of sensitivities from low to moderate and a low to medium importance in terms of nature conservation status.

Project impact assessment: Capital dredge and dredge disposal

9.8.158 The relative risk and distances at which mortality and potential mortal injury, TTS and behavioural effects in fish are predicted to occur as a result of the dredging and vessel movements associated with the construction and operation of the Project are included in **Appendix 9.B [TR030008/APP/6.4**].

9.8.159 The qualitative guidelines for continuous noise sources (Ref 9-102) consider that the risk of mortality and potential mortal injury in all fish is low in the near, intermediate and far-field. Applying the cumulative SEL thresholds for marine piling (Ref 9-102) on a precautionary basis, indicate that there is a risk of mortality/potential mortal injury within 50m in fish with a swim bladder involved in hearing, within 30m in fish with a swim bladder that is not involved in hearing and 10m for fish with no swim bladder.

9.8.160 According to Ref 9-102, the risk of recoverable injury is also considered low for fish with no swim bladder and fish with a swim bladder that is not involved in hearing. There is a greater risk of recoverable injury in fish where the swim bladder is involved in hearing (e.g. herring) whereby a cumulative noise exposure threshold is recommended (170 dB rms for 48h). The distance at which recoverable injury is predicted in these fish as a result of the dredging and vessel movements is 10m. Applying the cumulative SEL thresholds for marine piling (Ref 9-102) on a precautionary basis, indicate that there is a risk of recoverable injury within 80m in fish with a swim bladder and 20m for fish with no swim bladder.

9.8.161 Ref 9-102 advises that there is a moderate risk of a TTS occurring in the nearfield (i.e. tens of metres from the source) in fish with no swim bladder and fish with a swim bladder that is not involved in hearing and a low risk in the intermediate and far-field. There is a greater risk of TTS in fish where the swim bladder is involved in hearing (e.g. herring) whereby a guideline quantitative threshold is recommended (158 dB rms for 12 h). The distance at which TTS is predicted in these fish as a result of the dredging and vessel movements is 50m. Applying the cumulative SEL thresholds for marine piling (Ref 9-102) on a

precautionary basis, indicate that there is a risk of TTS occurring within 700m in all fish.

9.8.162 Popper *et al.* (2014) (Ref 9-102) guidelines suggest that there is considered to be a high risk of potential behavioural responses occurring in the nearfield (i.e. tens of metres from the source) for fish species with a swim bladder involved in hearing and a moderate risk in other fish species. At intermediate distances (i.e. hundreds of metres from the source), there is considered to be a moderate risk of potential behavioural responses in all fish and in the farfield (i.e. thousands of metres from the source) there is considered to be a low risk of a response in all fish.

9.8.163 Overall, there is generally considered to be a low risk of any injury in fish as a result of the underwater noise generated by dredging and vessel movements although mortality/potential mortal injury or recoverable injury could potentially occur in very close proximity to the dredger, particularly in fish where the swim bladder is involved in hearing (e.g. herring). The level of exposure will depend on the position of the fish with respect to the source, the propagation conditions, and the individual's behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a dredger for extended periods within the distances at which mortality/potential mortal injury or recoverable injury are predicted in fish as a result of the dredging and vessel movements. TTS and behavioural responses are anticipated to be relatively localised in scale and, in the context of the estuary width and the unconstrained nature of the location, fish will be able to move away and avoid the source of the noise as required. Furthermore, the period of capital dredging during construction will be very short term and temporary, lasting a period of approximately 12 days in total.

9.8.164 It is also important to consider the noise from dredging and vessel movements against existing background or ambient noise conditions. The levels of underwater noise generated by dredging and vessel movements are predicted to reach existing background levels previously measured in the Humber Estuary within around 100m from the source. Furthermore, the estuary and location of the proposed works already experiences regular vessel operations and ongoing maintenance dredging, and, therefore, fish are already habituated to a similar level of anthropogenic background noise.

9.8.165 Based on the above considerations, the overall magnitude of the change in underwater noise due to dredging and possible disposal activities is considered to be minor. Probability of occurrence is high and thus the overall exposure to change is low. While sensitivities of fish to underwater noise ranges from low to moderate depending on the Popper *et al.* (Ref 9-102) category within which the fish species falls, vulnerability is assessed as low. The importance of fish ranges from high for fish of high nature conservation status to low for resident fish with no protected status and which are not of commercial value. Overall, therefore, the impact of underwater noise during dredging and disposal activities on fish is considered to be **insignificant** for resident fish and **minor adverse** for fish of high nature conservation status**.**

Marine Mammals

9.8.166 This section contains an assessment of the potential impacts to marine mammal receptors as a result of the construction phase of the Project. The following impact pathway has been assessed:

o. Underwater noise and vibration during marine piling, capital dredging and dredge disposal.

Underwater noise and vibration during marine piling, capital dredging and dredge disposal

General scientific context

9.8.167 Elevated underwater noise and vibration levels during construction activities has the potential to cause physiological damage and induce adverse behavioural reactions. A detailed Underwater Noise assessment has been undertaken for the Project (**Appendix 9.B [TR030008/APP/6.4]**) and is briefly summarised in this section.

9.8.168 For most marine piling activities, the main source of noise and vibration relates to where piles are hammered or vibrated into the ground. Percussive (impact) marine piling involves hammering the pile into the seabed resulting in an impact blow and high levels of noise. Vibro marine piling produces lower levels of noise as piles are vibrated into the seabed.

9.8.169 The dredging process involves a variety of sound generating activities which can be broadly divided into sediment excavation, transport and placement of the dredged material at the disposal site (Ref 9-97; Ref 9-98; Ref 9-99). For most dredging activities, the main source of sound relates to the vessel engine noise.

9.8.170 Marine mammals are particularly sensitive to underwater noise at higher frequencies and generally have a wider range of hearing than other marine fauna, namely fish (i.e. their hearing ability spans a larger range of frequencies). The hearing sensitivity and frequency range of marine mammals varies between different species and is dependent on their physiology.

9.8.171 The National Oceanic and Atmospheric Administration (“NOAA”) (Ref 9-110) provides technical guidance for assessing the effects of underwater anthropogenic (human-made) sound on the hearing of marine mammal species. Specifically, the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to impulsive and non-impulsive underwater anthropogenic sound sources are provided. These thresholds update and replace the previously proposed criteria in Ref 9-108 for preventing auditory/physiological injuries in marine mammals. Further recommendations have recently been published regarding marine mammal noise exposure by Southall *et al* (Ref 9-109) which complement the NOAA (Ref 9-110) thresholds and also look at a wider range of marine mammal species.

9.8.172 The NOAA (Ref 9-110) and Southall *et al* (Ref 9-109) thresholds are categorised according to marine mammal hearing groups. The key marine mammal species found in the study area for the Project comprise harbour porpoise, common seal and grey seal. According to the NOAA (Ref 9-110), harbour porpoise is categorised as a high-frequency ("HF") cetacean and common and grey seals are categorised as phocid pinniped ("PW") (earless seals or "true seals").

9.8.173 There are no equivalent SPL behavioural response criteria that would represent the sources of underwater noise associated with the Project. Behavioural reactions to acoustic exposure are less predictable and difficult to quantify than effects of noise exposure on hearing or physiology as reactions are highly variable and context specific (Ref 9-108). Instead, a desk-based review of the observations from field studies has been undertaken, as reported in detail in **Appendix 9.B [TR030008/APP/6.4]**.

9.8.174 Field studies have demonstrated behavioural responses of harbour porpoises to anthropogenic noise (Ref 9-111). A number of studies have shown avoidance of pile driving activities during offshore wind farm construction (Ref 9-112; Ref 9-113; Ref 9-114), with the range of measurable responses extending to at least 21km in some cases (Ref 9-115). Seismic surveys have also elicited avoidance behaviour in harbour porpoises, albeit short-term (Ref 9-116), and monitoring of echolocation activity suggests possible negative effects on foraging activity in the vicinity of seismic operations (Ref 9-117). There is a scarcity of studies quantifying behavioural impacts from dredging (Ref 9-118). One investigation showed that harbour porpoises temporarily avoided an area of sand extraction off the Island of Sylt in Germany (Ref 9-119). This study found that, when the dredging vessel was closer than 600m to the porpoise detector location, it took three times longer before a porpoise was again recorded than during times without sand extraction. However, after the ship left the area, the clicks made by harbour porpoise (for echolocation) resumed to the baseline rate (Ref 9-119).

9.8.175 Few studies have documented responses of seals to underwater noise in the field (Ref 9-111). Tracking studies found reactions of the grey seals to pile driving during the construction of windfarms were diverse (Ref 9-120). These included altered surfacing or diving behaviour, and changes in swim direction including swimming away from the source, heading into shore or travelling perpendicular to the incoming sound, or coming to a halt. Also, in some cases no apparent changes in their diving behaviour or movement were observed. Of the different behavioural changes observed a decline in descent speed occurred most frequently, which suggests a transition from foraging (diving to the bottom), to more horizontal movement. These changes in behaviour were on average larger, and occurred more frequently, at smaller distances from the pile driving events, and such changes were statistically significantly different at least up to 36km from the marine piling. In addition to changes in dive behaviour, also changes in movement were recorded. There was evidence that on average grey seals within 33km were more likely to swim away from the pile driving. In some cases, seals exposed to pile-driving at close range, returned to the same area on subsequent trips. This suggests that some seals had an incentive to go to these areas, which was stronger than the deterring effect of the pile-driving.

9.8.176 A telemetry study found no overall significant displacement of common seal during construction of a wind farm in The Wash, south-east England (Ref 9-35). However, during marine piling, seal usage (abundance) was significantly reduced up to 25km from the marine piling activity; within 25km of the centre of the wind farm, there was a 19 to 83% (95% confidence intervals) decrease in usage compared to during breaks in marine piling, equating to a mean estimated displacement of 440 individuals. This amounts to significant displacement starting from predicted received levels of between 166 and 178 dB re 1 µPa (peak-peak). Displacement was limited to marine piling activity; within two hours of cessation of pile driving, seals were distributed as per the non-marine piling scenario.

9.8.177 A playback experiment was conducted on harbour seals in which the recorded sound of an operational wind turbine was projected via a loudspeaker, resulting in modest displacement of seals from the source (median distance was 284 vs 239m during control trials) (Ref 9-121). Two further studies of ringed seals (*Phoca hispida*), which are closely related to both harbour and grey seals, have observed behaviour in response to anthropogenic noise: Animals have been reported swimming away and avoidance within ~150m of a seismic survey(Ref 9-129), while other studies have found no discernible difference in seal densities in response to construction and drilling for an oil pipeline (Ref 9-122).

9.8.178 A number of field observations of harbour porpoise and pinnipeds to multiple pulse sounds have been made and are reviewed by Ref 9-108. The results of these studies are considered too variable and context-specific to allow single disturbance criteria for broad categories of taxa and of sounds to be developed. Another way to evaluate the responses of marine mammals and the likelihood of behavioural responses is by comparing the received sound level against species specific hearing threshold levels. Further information on the dBht metric and its limitations is provided in **Appendix 9.B [TR030008/APP/6.4**].

Project impact assessment: Marine piling

9.8.179 The distances at which permanent threshold shifts (“PTS”), TTS and behavioural effects in marine mammals that occur in the study area are predicted to occur during impact marine piling and vibro marine piling for the Project are included in **Appendix 9.B [TR030008/APP/6.4].**

9.8.180 As discussed above for fish, the Project will involve the installation of piles of varying sizes. The largest piles that will be driven for the Project comprise two 2.3m diameter piles, which represent a very small proportion of all the piles (< 1 %). In addition to modelling the propagation of noise associated with these larger 2.3m diameter piles as a worst case, therefore, the propagation of noise associated with the second largest 1.5m diameter piles, which comprise a more significant proportion of all the piles (45 %), has also been modelled.

9.8.181 The distances at which PTS and TTS in marine mammals are predicted to occur during impact marine piling of 2.3m and 1.5m diameter piles are included in **Table 9-18** and **Table 9-19**.

Table 9-18: Approximate distances (metres) marine mammal response criteria are reached during impact marine piling 2.3m diameter piles

Marine Mammal Hearing Group	PTS		TTS	
	SEL_{cum}	Peak	SEL_{cum}	Peak
Harbour porpoise	3,000	100	20,000	200
Common seal and grey seal	2,000	10	10,000	30

Table 9-19: Approximate distances (metres) marine mammal response criteria are reached during impact marine piling 1.5m diameter piles

Marine Mammal Hearing Group	PTS		TTS	
	SEL_{cum}	Peak	SEL_{cum}	Peak
Harbour porpoise	2,000	40	10,000	90
Common seal and grey seal	800	5	5,000	10

9.8.182 There is predicted to be a risk of instantaneous PTS and TTS in harbour porpoise within approximately 100m and 200m respectively from the source of the percussive marine piling noise of 2.3m diameter piles, and within approximately 40m and 90m respectively from the source of the percussive marine piling noise of 1.5m diameter piles. The risk of instantaneous PTS and TTS in seals is within approximately 10 and 30m respectively from the source of the percussive (impact) marine piling of the 2.3m diameter piles and within approximately 5m and 10m respectively of the 1.5m diameter piles.

9.8.183 If the propagation of underwater noise from impact marine piling were unconstrained by any boundaries, the maximum theoretical distance at which the predicted SEL_{cum} weighted levels of underwater noise during impact marine piling is within the limits of PTS and TTS in harbour porpoise is approximately 3km and 20km respectively for 2.3m diameter piles (**Table 9-18**) and approximately 2km and 10km respectively for 1.5m diameter piles (**Table 9-19**). The maximum distance for PTS and TTS in seals is approximately 2km and 10km respectively for 2.3m diameter piles (**Table 9-18**), and 800m and 5km respectively for 1.5m diameter piles **(Table 9-19**).Assuming a worst case of a lower swimming speed of 1.5m/s for all marine mammal species (including both adults and juveniles), the maximum time that it would take harbour porpoise to leave the centre of the cumulative SEL weighted PTS and TTS injury zones during impact marine piling is estimated to be around 30 minutes and four hours respectively for 2.3m diameter piles and around 20 minutes and 2 hours respectively for 1.5m diameter piles. This is less than 17 % of the time that would be required for an injury to occur and, therefore, assuming harbour porpoise evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during impact marine piling. The maximum time that would take seals to leave the PTS and TTS zones is estimated to be 20 minutes and two hours respectively for 2.3m diameter piles and around 9 minutes and one hour respectively for 1.5m

diameter piles. This is less than 9 % of the time that would be required for an injury to occur and, therefore, assuming seals evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during impact marine piling.

9.8.184 The distances at which PTS and TTS in marine mammals are predicted to occur during vibro marine piling activities associated with the construction of the proposed development for either 2.3m diameter or 1.5m diameter piles are included in **Table 9-20**.

Table 9-20: Approximate distances (metres) marine mammal response criteria are reached during vibro marine piling

Marine Mammal Hearing Group	PTS	TTS
High-frequency (HF) cetaceans (porpoises, river dolphins)	200	2,000
Phocid pinniped (PW) (true seals)	80	1,000

9.8.185 If the propagation of underwater noise from vibro marine piling were unconstrained by any boundaries, the maximum theoretical distance at which the predicted SEL_{cum} weighted levels of underwater noise during vibro marine piling is within the limits of PTS and TTS in harbour porpoise is 200m and 2km respectively. The maximum distance for PTS and TTS in seals is 80m and 1km respectively.

9.8.186 Assuming a worst case of a lower swimming speed of 1.5m/s for all marine mammal species (including both adults and juveniles), the maximum time that would take harbour porpoise to leave the centre of the cumulative SEL weighted PTS and TTS injury zones during vibro marine piling is estimated to be around two minutes and 30 minutes respectively. This is less than 3% of the time that would be required for an injury to occur and, therefore, assuming harbour porpoise evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during vibro marine piling. The maximum time that it would take seals to leave the PTS and TTS zones is estimated to be around one minute and ten minutes respectively. This is less than 1% of the time that would be required for an injury to occur and, therefore, assuming seals evade the injury effects zone, they are not considered to be at risk of any permanent or temporary injury during vibro marine piling.

9.8.187 Impact marine piling is predicted to cause instantaneous injury effects within close proximity to the activity and strong behavioural responses over a wider area although this will be constrained to within the outer section of the Humber Estuary between Hull and Cleethorpes.

9.8.188 The results indicate that if any marine mammals present in the Humber Estuary were to remain stationary within the cumulative SEL distances from the source of marine piling over a 24-hour period, it could result in temporary and/or permanent hearing injury. However, it is considered highly unlikely that any individual marine mammal will stay within this “injury zone” during the marine piling operations.

9.8.189 Any marine mammals present are likely to evade the area. Behavioural responses could include movement away from a sound source, aggressive behaviour related to noise exposure (e.g. tail/flipper slapping, fluke display, abrupt directed movement), visible startle response and brief cessation of reproductive behaviour (Ref 9-108). Mild to moderate behavioural responses of any individuals within these zones could include movement away from a sound source and/or visible startle response (Ref 9-108).

9.8.190 Any evasive response could also lead to the potential temporary avoidance of the outer section of the Humber Estuary between Hull and Cleethorpes. There is therefore considered the potential for the restriction of the movements of marine mammals upstream and downstream (i.e. a barrier to movements). The Humber Estuary upstream of the Project is not known to be used as a breeding site for seals (with the nearest known breeding colony located over 25km away at Donna Nook at the mouth of the estuary). However, as noted in the baseline (**Section 9.6**), seals and harbour porpoise are regularly recorded foraging in the Humber Estuary and have been observed within several kilometres of the Project. While numbers at any given time in the Immingham area will only represent a small proportion of regional populations[13], foraging individuals or small pods (harbour porpoise) in this area are nevertheless expected to occur relatively frequently. Any barrier to movements caused by the noise during marine piling would be temporary with significant periods of a 24-hour period when no marine piling will be undertaken (see below) which will allow the unconstrained movements of marine mammals through the Humber Estuary. Marine mammals are also highly mobile and wide ranging and therefore are likely to be able to exploit other areas for foraging during any marine piling.

9.8.191 The effects of marine piling noise on marine mammals also need to be considered in terms of the duration of exposure. Marine piling noise will take place over a period of approximately 343 days. Marine piling will not take place continuously as there will be periods of downtime, pile positioning and set up.

9.8.192 The piling works will be undertaken seven days per week. Intended working hours will be from 07:00 to 19:00 in winter months (1 September to 31 March inclusive) and sunrise to sunset in the summer months). The maximum impact marine piling scenario is for three tubular piles to be installed each day using up to two marine piling rigs pile driving at any one time, involving approximately 270 minutes of impact marine piling per day and 60 minutes of vibro marine piling per day in a 12 hour shift. There will, therefore, be significant periods over a 24-hour period when marine mammals will not be disturbed by any marine piling noise. The actual proportion of impact marine piling is estimated to be at worst around 23 % over a 24-hour period (based on 270 minutes of impact marine piling and 60 minutes of vibro marine piling each working day) over any given construction week. In other words, any marine mammals that remain within the

[13] The Humber Estuary/Lincolnshire coast region supports thousands of grey seals with counts over 4,000-6,000 seals recorded hauling out and over 2,000 pups born in recent years at Donna Nook. In addition, counts of approximately 100-150 common seals have also been recorded at Donna Nook in recent years. An estimated abundance of over 50,000 harbour porpoises was estimated for the southern North Sea region based on (SCANS) III data (**Section 9.6**).

predicted behavioural effects zone at the time of percussive marine piling will not be exposed up to 77% of the time over the period of a day.

9.8.193 Furthermore, as stated in **Section 9.6**, grey seals can undertake wide ranging seasonal movements over several thousand kilometres (Ref 9-136; Ref 9-132; Ref 9-137). Seals tagged at Donna Nook were recorded undertaking wide ranging movements in the outer Humber Estuary and approaches as well as more widely in the North Sea (Ref 9-137). Therefore, seals are likely to be able to exploit a much wider area for foraging during any marine piling activity.

9.8.194 It is also important to consider the noise from marine piling against existing background or ambient noise conditions. The levels of underwater noise generated by impact marine piling are predicted to reach existing background levels previously measured in the Humber Estuary within around 2 to 3km from the source. The levels of underwater noise generated by vibro marine piling are predicted to reach background levels within around 1 km from the source. Furthermore, the vicinity of the area in which the construction will take place already experiences constant vessel operations and ongoing maintenance dredging, and, therefore, marine mammals are likely to be habituated to a certain level of anthropogenic background noise.

9.8.195 Applying the standard impact assessment criteria in the assessment, the probability of occurrence of underwater noise disturbance during marine piling is high. The magnitude of the change is, however, considered likely to be small to medium, taking account of the scale of change, short term and temporary nature of the marine piling works and highly mobile nature of marine mammals. The sensitivity of marine mammal species to marine piling noise is considered to be moderate[14] . In addition, the importance of marine mammal species is considered to be high given the level of protection that they are afforded. As a consequence, the temporary underwater noise effect on marine mammals during marine piling is assessed as **minor** to **moderate adverse**.

Project impact assessment: Capital dredge and dredge disposal

9.8.196 The distances at which PTS and TTS and behavioural effects in marine mammals that occur in the study area are predicted to occur as a result of the dredging and vessel movements to and from the disposal sites associated with the Project are included in **Appendix 9.B [TR030008/APP/6.4]**.

9.8.197 NOAA's user spreadsheet tool (Ref 9-110) has been used to predict the range at which the weighted cumulative SEL acoustic thresholds (Ref 9-110) for PTS and TTS are reached during the proposed dredging and disposal activity based on the assumptions highlighted in **Appendix 9.B [TR030008/APP/6.4]**.

[14] Moderate sensitivity was assigned on the basis that relatively localised injury effects (and behavioural responses over a wider area) are predicted from the anticipated level of underwater noise generated by the marine piling. However, the zones of potential injury and behavioural responses would be expected to be lower than for other activities such as the percussive marine piling of larger offshore tubular piles, seismic survey or blasting operations.

9.8.198 There is predicted to be no risk of PTS in harbour porpoise and the risk of TTS is limited to within around 40m from the dredging or vessel activity. There is predicted to be no risk of PTS in seals and the risk of TTS is limited to within around 10 m from the source.

9.8.199 Overall, there is not considered to be any risk of injury or significant disturbance to marine mammals from the proposed dredging and vessel activities that are proposed at the Port of Immingham for the Project even if the dredging and vessel movements were to take place continuously 24/7. Furthermore, the period of capital dredging during construction will be very short term and temporary, lasting a period of around 12 days.

9.8.200 The probability of a change in underwater noise occurring during dredging and dredge disposal is high. However, hearing damage is unlikely to occur and the main effect that could be expected in the vicinity of the dredge vessels would be short-term mild behavioural avoidance. Based on these factors, the magnitude of the change due to dredging noise is considered to be negligible and the sensitivity of marine mammals to dredging noise is considered to be low. Taking these factors into account, the overall exposure and vulnerability of marine mammals will be negligible and none respectively. Overall, therefore, the impacts of dredging noise on all marine mammals are considered to be **insignificant.**

Operation

9.8.201 This section contains an assessment of the potential impacts to marine ecology receptors as a result of the operational phase of the Project – those effects being reviewed in **Table 9-21**. This section includes an explanation of the rationale that was adopted for scoping in or out individual pathways for further assessment.

9.8.202 During operation of the Project, maintenance dredging will potentially be required in the same way as currently occurs at the Port of Immingham with the same dredging techniques used. The modelling of the Project (as reported in **Chapter 16: Physical Processes [TR030008/APP/6.2]**) indicates that the berth pocket, once dredged, will remain swept clear of deposited material by the flood and ebb tidal flows (in much the same way the existing Immingham Oil Terminal berths are). Consequently, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).

9.8.203 Should maintenance dredging be required it is proposed to be incorporated within the maintenance dredge licence for Immingham (L/2014/00429/1) as part of the renewal of the licence at the end of 2025.

9.8.204 If maintenance dredging for the Project is required periodically this will be carried out in line with the existing regime. The frequency and volume of material deposited at the disposal site from each load (for maintenance dredging across the port) will not change compared with current maintenance dredging activities as the same plant and methods are proposed to be used. Furthermore, the volume of material that will need to be maintenance dredged from the berth pocket will be lower than the volumes of capital dredge material. Overall, the changes brought about as a result of the maintenance dredge and disposal of maintenance dredge material during operation will be comparable to that which already arises from the ongoing maintenance of the existing Port of Immingham

berths. Therefore, it is considered that the likely impacts on marine receptors as a result of maintenance dredging will be comparable to the existing maintenance dredge regime. The magnitude of potential impacts is also considered to be lower than the capital dredge. On this basis, potential effects associated with all the maintenance dredging pathways that have been assessed as insignificant are discussed in **Table 9-21** but have been scoped out of a more detailed assessment to avoid unnecessary repetition of text.

Table 9-21: Potential effects during operation scoped in/out of the further detailed assessment undertaken

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
Benthic habitats and species	Direct changes to benthic habitats and species beneath marine infrastructure due to shading	Operation	Yes	Changes in sunlight levels as a result of shading due to marine infrastructure has the potential to cause changes to the benthic community occurring in an area. This impact pathway has, therefore, been scoped into the assessment.
	Changes to benthic habitats and species as result of seabed removal during dredging	Maintenance dredging	Yes	Maintenance dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site. Given that the dredge footprint has not previously been subject to any maintenance dredging, this impact pathway has, therefore, been scoped into the assessment.
		Dredge disposal	N/A	This pathway relates to changes in habitat resulting directly from seabed removal and is, therefore, not considered relevant to the dredge disposal activity. Potential effects resulting from sediment deposition at the disposal site are discussed below.
	Changes to habitats and species as a result of sediment deposition	Maintenance dredging and disposal	No	Maintenance dredge and dredge disposal will result in the deposition of sediments which has the potential to cause physical disturbance and smothering of seabed habitats. As a result of the expected limited maintenance dredging requirements, smaller changes in SSC and sedimentation (within the dredge plumes and at the disposal site) as compared to the capital dredge will occur. Deposition of sediment as a result of dredging will be highly localised

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				and similar to background variability. The benthic species occurring within and near to the dredge area typically consist of burrowing infauna (such as polychaetes and oligochaetes), which are considered tolerant to some sediment deposition. Based on evidence provided in relevant MarESA assessments, the characterising species recorded in the project-specific subtidal survey (described above) are considered tolerant to deposition of at least 50mm with many species considered capable of burrowing through much greater levels of sediment deposition. The predicted millimetric changes in deposition are, therefore, considered unlikely to cause smothering effects. In addition, the species recorded in the benthic invertebrate surveys are fast growing and/or have rapid reproductive rates which allow populations to typically rapidly recolonise disturbed habitats, many within a few months following the disturbance events (Ref 9-77; Ref 9-74; Ref 9-75; Ref 9-76). The disposal site is located in the mid channel and is subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows. This is reflected in a generally impoverished assemblage at both disposal sites. In addition, millions of wet tonnes of dredge sediment are disposed of at HU060 annually which will also cause some disturbance due to sediment deposition. The benthic species recorded include mobile infauna (such as errant polychaetes e.g. *Arenicola* spp. and amphipods) which are able to burrow through sediment. They are, therefore, considered tolerant to some sediment deposition. In addition, characterising species typically have opportunistic life history strategies, with short life histories (typically two years or less), rapid maturation and the production of large numbers of small propagules which makes them capable of rapid recoverability should mortality as a result of smothering occur (Ref 9-77; Ref 9-74; Ref 9-75; Ref 9-76). On this basis, any effects are

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				considered to be temporary and short term. Based on the available information provided above, the potential impact has been assessed as **insignificant**.
	Indirect changes to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes	Maintenance dredging and disposal	No	The predicted physical processes impacts from future maintenance dredging will be similar to that which already arises from the ongoing maintenance of the existing Immingham berths. Maintenance dredging has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). However, changes in hydrodynamic and sedimentary processes that are of a negligible magnitude are expected as a result of the expected limited maintenance dredging requirements. Such changes are unlikely to be discernible against natural processes at nearby intertidal habitats. Furthermore, such changes are not expected to modify existing subtidal habitat types found in the area. Based on the available information provided above, the potential impact has been assessed as **insignificant**.
	Changes in water and sediment quality	Maintenance dredge and dredge disposal	No	The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). Consequently, changes in water quality lower than for the capital dredge and at worst similar to existing maintenance dredging is expected. Elevated SSCs due to maintenance dredging and dredge disposal are anticipated to be of a magnitude that can occur naturally or as a result of existing maintenance dredging/disposal and sediment plumes resulting from dredging would also be expected to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				Naturally very high SSCs typically occur year-round in the Humber Estuary, particularly during the winter months when storm events disturb the seabed and on spring tides. The estuarine benthic communities recorded in the region are considered tolerant to this highly turbid environment (Ref 9-77; Ref 9-74; Ref 9-75; Ref 9-76). With respect to sediment contamination, the results of the sediment contamination sampling are summarised above, and in the Water and Sediment Quality chapter (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**). In summary, generally low levels of contamination were found in the samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment. During maintenance dredging and dredge disposal, sediment will be rapidly dispersed in the water column. Therefore, the already low levels of contaminants in the dredged sediments will be dispersed further. Based on the available information provided above, the potential impact has been assessed as **insignificant**.
		Surface water drainage	No	Standard measures to control surface water run-off during operation are embedded within the Project design for legislative compliance, and therefore there would be no potential for pollution to the Humber Estuary. This impact pathway has, therefore, been scoped out of the assessment.
	Underwater noise	Vessel operations, maintenance dredge and dredge disposal	No	Population level and mortality effects in benthic invertebrates are considered unlikely for marine piling or blasting. Maintenance dredging is known to produce lower noise levels than marine piling or blasting, and, therefore, there is unlikely to be significant effects on benthic

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				invertebrates and this impact pathway has been scoped out of the assessment.
	Non-native species transfer during vessel operations	Vessel operations	Yes	Non-native species have the potential to be transported into the local area on the hulls of vessels during operation. Non-native invasive species also have the potential to be transported via vessel ballast water. This impact pathway has, therefore, been scoped into the assessment.
	Damage to sensitive habitats as a result of changes in air quality.	Road traffic emissions	No	There are no designated nature conservation receptors within 200m of a road that exceeds the IAQM and EPUK screening guidance on local roads (see **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**), below which a road traffic impact is unlikely to contribute to a significant effect on local air quality. This impact pathway has, therefore, been scoped out of the assessment.
		Marine vessel emissions and landside plant emissions	Yes	Emissions from docked marine vessels and landside plant during operation have been modelled in **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**. The potential for NO_x, NH_3, SO_2 and N deposition to affect designated habitats that are sensitive to these emission sources within the Humber Estuary EMS has been identified, and this impact pathway has, therefore, been scoped into the assessment.
Fish	Changes to fish populations and habitat	Maintenance dredge and dredge disposal	No	As summarised above, impacts on benthic prey and fish receptors as a result of maintenance dredging are anticipated to be lower than the capital dredge and comparable to the existing maintenance dredge regime in the wider area. The maintenance dredge footprint and proposed disposal site are considered unlikely to provide important nursery or spawning functions for fish species as a result of the disturbed nature of these habitats

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				despite known nursery or spawning areas occurring in the wider Humber Estuary area[15]. Therefore, while during dredging, there is the potential for fish along with roe (eggs) of these species to be removed, sub-optimal spawning conditions are likely to be present with more optimal habitat occurring in the wider Humber Estuary area. In addition, the dredge footprint is considered negligible in extent in the context of suitable spawning habitat in the region. As summarised above, the predicted impacts on benthic habitats and species (and therefore prey for fish receptors) as a result of maintenance dredging are considered to be lower than the capital dredge and comparable to the existing maintenance dredge regime. Most fish species are opportunistic and generalist feeders, which means that they are generally not reliant on a single prey item. Fish are also mobile species and will easily be able to move away from the zone of influence and utilise other nearby areas for foraging. Furthermore, the area of habitat change will only represent a small proportion of the foraging ranges of many fish species (particularly the larger and more commercial species such as whiting, plaice and Dover sole). Based on the available information provided above, the potential impact has been assessed as **insignificant**.
	Changes in water and sediment quality	Maintenance dredge and dredge disposal	No	Changes in water quality are also expected to be lower than for the capital dredge and at worst similar to existing maintenance dredging.

[15] The maintenance dredge footprint and nearby area is already subject to regular natural seabed disturbance due to very strong tidal currents. The disposal ground is located in a highly dynamic area with the mobile sandbanks subject to regular natural physical disturbance (and associated scouring) as a result of very strong tidal flows and deposition due to regular maintenance dredge activity.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				Fish within the Humber Estuary are well adapted to living in an area with variable and typically high suspended sediment loads. Fish feed on a range of food items and, therefore, their sensitivity to a temporary change in the availability of a particular food resource is considered to be low. Their high mobility enables them to move freely to avoid areas of adverse conditions and to use other food sources in the local area. With specific respect to migratory fish, salmonids and other migratory fish can be sensitive to elevated suspended sediment concentrations. However, these species are known to migrate through estuaries with high suspended sediment concentrations (including the Humber Estuary). Elevated SSCs due to dredging are anticipated to be of a magnitude that can occur naturally or as a result of ongoing maintenance dredging/disposal. Sediment plumes resulting from dredging and dredge disposal are also expected to dissipate relatively rapidly and be immeasurable against background levels within a relatively short duration of time. Therefore, salmonids and other migratory fish would also be able to avoid the temporary sediment plumes. Based on these factors there is therefore considered limited potential for migrating fish to be adversely affected by the predicted changes in SSC. Given that elevated SSCs due to dredge and dredge disposal are considered to be in the range of variability that can occur naturally in the Humber Estuary (which has very high SSCs year-round, particularly during the winter months) as well as due to existing ongoing maintenance dredging/disposal and that plumes will be temporary in nature, sensitive life stages of fish occurring in the region such as larvae and juvenile fish are considered unlikely to be adversely effected by the dredging.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				With respect to sediment contamination, the results of the sediment contamination sampling are summarised above, and in the Water and Sediment Quality chapter (**Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**). In summary, generally low levels of contamination were found in the samples and there is no reason to believe the sediment will be unsuitable for disposal in the marine environment. Based on the available information provided above, the potential impact has been assessed as **insignificant**.
	Underwater noise	Maintenance dredge and dredge disposal	No	The outcomes of the assessment of underwater noise disturbance from capital dredging activities during construction will be the same for maintenance dredging activities during operation. A worst-case source level for all types of dredgers has been applied to the underwater noise assessment and, therefore, the predicted ranges of effect are applicable to both the maintenance and capital dredging activities. Underwater noise effects on fish during capital dredging were assessed as insignificant for resident fish minor adverse for fish of high nature conservation status. However, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). On this basis, the magnitude of potential impact during maintenance dredging is considered to be **insignificant** for all fish species. The detailed assessment of the effects of underwater noise from capital dredge activities is the same for maintenance dredging activities and has therefore not been included in this section of the chapter to avoid unnecessary repetition.
	Underwater noise	Vessel operations	No	During the operational phase there is the potential for noise disturbance to fish species as a result of vessel movements. The worst-case source level associated with vessels during operation is the same as for

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
				dredging activity. Only mild behavioural responses for fish species in relative proximity to operational vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area given the high levels of existing background vessel noise in the area. Furthermore, the additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area (approximately a 3% increase). This impact pathway has, therefore, been scoped out of the assessment.
	Lighting	Vessel operations	No	The jetty/pier decking will be lit for safety and operational purposes. Lighting design will be optimised to avoid any unnecessary light-spill on the water or foreshore habitats. For any shoaling fish near the surface, the Project will potentially only cause minor changes in behaviour such as increased shoaling in the vicinity of the light source. Such responses could increase the risk of predation but could also have positive effects such as enhancing feeding efficiency. The low levels of lighting would not cause disruption or blocking of migratory routes. The potential effect has been scoped out of more detailed assessment.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
Marine mammals	Underwater noise	Maintenance dredge and dredge disposal	No	The outcomes of the assessment of underwater noise disturbance from capital dredging activities during construction will be the same for maintenance dredging activities during operation. A worst-case source level for all types of dredgers has been applied to the underwater noise assessment and, therefore, the predicted ranges of effect are applicable to both the maintenance and capital dredging activities. The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). On this basis, the potential effect is, therefore, considered to be **insignificant**. The detailed assessment of the effects of underwater noise from capital dredge activities is the same for maintenance dredging activities and has therefore not been included in this section of the chapter to avoid unnecessary repetition.
	Underwater noise	Vessel operations	No	During the operational phase there is the potential for noise disturbance to marine mammal species as a result of vessel movements. The worst-case source level associated with vessels during operation is the same as for dredging activity. Only mild behavioural responses for marine mammals species in relative proximity to operational vessels are anticipated with noise levels unlikely to be discernible above ambient levels in the wider Humber Estuary area given the high levels of existing background vessel noise in the area. Furthermore, the additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area (approximately a 3% increase). This impact pathway has, therefore, been scoped out of the assessment.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
	Visual disturbance of hauled out seals	Vessel operations, maintenance dredge and dredge disposal	No	The nearest established breeding colony for grey seals is located over 25 km away at Donna Nook. Approximately 10 to 15 grey seals were also observed hauling out on mudflat at Sunk Island (on the north bank of the Humber Estuary) during recent benthic surveys as detailed in Ref 9-47. This haul out site is located approximately 4km north-east from the Project. No seal haul out sites are known to occur nearer to the Project. Seals which are hauled out on land, either resting or breeding, are considered particularly sensitive to visual disturbance (Ref 9-67). The level of response of seals is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the disturbance source. Hauled out seals have been recorded becoming alert to powered craft at distances of up to 800m although seals generally only disperse into the water at distances <150-200m (Ref 9-68; Ref 9-69; Ref 9-70; Ref 9-71). For example, in a study focusing on a colony of grey seals on the South Devon coast, vessels approaching at distances between 5m and 25m resulted in over 64 % of seals entering the water, but at distances of between 50m and 100m only 1 % entered the water (Ref 9-72). Recent disturbance research has also found no large-scale redistribution of seals after disturbance with most seals returning to the same haul out site within a tidal cycle (Ref 9-73). Based on this evidence, seals hauled out on the intertidal habitats of Sunk Island (located on the opposite bank to the Project) are out of the zone of influence of any potential visual disturbance effects as a result of maintenance dredging and vessel operations. The potential for disturbance to hauled out seals has, therefore, been scoped out of the assessment.

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
	Collision risk	Vessel operations	No	Vessels using the berths during operation will be typically approaching at slow speeds (2-4 knots) and maintenance dredging/dredge disposal will be mainly stationary or travelling at low speeds (2-6 knots), making the risk of collision very low. Although all types of vessels may collide with marine mammals, vessels traveling at speeds over ten knots are considered to have a much higher probability of causing lethal injury (Ref 9-50). Furthermore, the region is already characterised by heavy shipping traffic. The additional operational vessel movements resulting from the proposed development will only constitute a small increase in vessel traffic in the area (approximately a 3% increase). In general, incidents of mortality or injury of marine mammals caused by vessels remain a relatively rare occurrence in UK waters (Ref 9-51; Ref 9-52). For example, out of 144 post mortem examinations carried out on cetaceans in 2018, only two (1.4 %) were attributed to boat collision with the biggest causes of mortality including starvation and by-catch, although some incidents are likely to remain unreported (Ref 9-52). In addition, marine mammals frequently foraging within the region will routinely need to avoid collision with vessels and are, therefore, considered adapted to living in an environment with high levels of vessel activity. This impact pathway has, therefore, been scoped out of the assessment.

Benthic Habitats and Species

9.8.205 This section contains an assessment of the potential impacts to benthic ecology receptors as a result of the operational phase of the Project. The following impact pathways have been assessed:

a. Changes to benthic habitats and species as result of seabed removal during maintenance dredging.

b. Direct changes to benthic habitats and species beneath marine infrastructure due to shading.

c. Non-native species transfer during vessel operations.

d. Changes in air quality due to marine vessel and landside plant emissions.

Changes to benthic habitats and species as result of seabed removal during maintenance dredging

General scientific context

9.8.206 Scientific evidence on this potential impact pathway has already been provided above in the construction (capital dredge) sub-section of the impact assessment and is, therefore, not repeated here.

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9.8.207 Maintenance dredging causes the direct physical removal of marine sediments from the dredge footprint, resulting in the modification of existing marine habitats. The impacts to benthic fauna associated with the dredged material include changes to abundance and distribution through damage, mortality or relocation to a disposal site.

9.8.208 As summarised above and in the physical processes assessment (**Chapter 16: Physical Processes** of the ES **[TR030008/APP/6.2]**), maintenance dredging is expected to be very limited (if required at all). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements but is anticipated there could be several years or more between maintenance dredge campaigns).

9.8.209 Maintenance dredging will create similar seabed sedimentary conditions to that occurring following capital dredging[16] with the surface layer of the seabed in the dredge footprint expected to be broadly comparable to the existing sediment character (i.e. sediment with a high silt content) following maintenance dredging.

[16] The baseline benthic surveys predominantly recorded surface sediment within and near to the dredge footprints with a high silt content (i.e., mud and sandy mud) (**Section 9.6** and **Appendix 9.A [TR030008/APP/6.4]**). Sub surface sampling in the capital dredge footprint recorded sediments from most sampling locations dominated by silt material (see **Appendix 2.A [TR030008/APP/6.4]**).

9.8.210 On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of the maintenance dredging area between maintenance dredging campaigns[17].

9.8.211 Furthermore, the highly impoverished benthic community recorded in the project-specific subtidal survey (**Appendix 9.A [TR030008/APP/6.4]**) (which is likely to reflect the existing high levels of physical disturbance in the area due to strong near bed tidal currents and sediment transport) is considered characteristic of subtidal habitats found more widely in this section of the Humber Estuary (Ref 9-124; Ref 9-23; Ref 9-24; Ref 9-22). All of the species recorded are considered commonly occurring and not protected.

9.8.212 Based on the evidence provided above and applying the project impact assessment methodology, the magnitude of the change to the subtidal habitats and associated benthic species is considered to be small and although the probability of occurrence is high, the overall exposure is assessed as low. The sensitivity of subtidal habitats to seabed disturbance within the dredge footprint is considered to be low given the high recoverability rates. Vulnerability is, therefore, assessed as low. While subtidal benthic communities are considered commonly occurring in the region, subtidal habitats form a component of the 'Estuaries' feature of the SAC. Importance is, therefore, considered to be moderate. Overall, the potential effect is assessed as **insignificant to minor adverse**.

Direct changes to benthic habitats and species beneath marine infrastructure due to shading

General scientific context

9.8.213 Artificial shading such as due to jetty/pier decking has the potential to cause localised changes to the structure and functioning of biological communities in natural ecosystems (Ref 9-124; Ref 9-125; Ref 9-126).

9.8.214 In sedimentary habitats microphytobenthos, macrofauna, sediment erodibility and biogeochemical sediment properties are often found to differ significantly between shaded and unshaded sediments (Ref 9-160; Ref 9-191; Ref 9-126). Microphytobenthos are significant drivers of ecosystem functioning in benthic habitats influencing biogeochemical properties of sediment, food web dynamics (Ref 9-192) and sediment erodibility (Ref 9-193). Heavy shading alters microphytobenthos assemblages causing a variety of responses, including changes in biomass, pigment ratios, species richness and diversity (Ref 9-190; Ref 9-126). These changes can therefore have cascading effects on the sediments they inhabit and associated faunal assemblages (Ref 9-191; Ref 9-

[17] The project-specific subtidal survey (**Appendix 9.A** [**TR030008/APP/6.4**]) recorded a highly impoverished benthic community characterised by polychaetes (such *Nephtys* spp, *Streblospio shrubsolii* and *Scoloplos armiger*), nematodes, oligochaetes *Tubificoides* spp and crustacean *Diastylis rathkei.* These species are typically fast growing and/or have rapid reproductive rates which allow populations to fully re-establish in typically less than 1-2 years and for some species within a few months (Ref 9-74; Ref 9-75; Ref 9-76).

124; Ref 9-126). For example, Tolhurst *et al*. (Ref 9-126) found heavy shading of an intertidal mudflat caused directional responses in sediment properties, in line with a decrease in microphytobenthos, including reductions in chlorophyll *a*, colloidal carbohydrate, erosion threshold and total carbohydrate; and increased erosion rate and water retention. This resulted in significant changes in the faunal assemblage, driven by large decreases in oligochaetes and sabellid polychaetes – likely to be a direct response to the reduction of food; either the amount of microphytobenthos, or perhaps bacteria, or meiofauna (Ref 9-126).

9.8.215 Shading of hard substrates, such as rocky shores and seawalls, can often alleviate stressful conditions associated with temperature and desiccation, caused by emersion during low tide (Ref 9-194). However, this can also cause shifts in the structure and diversity of biological communities, by reducing macroalgae cover (Ref 9-195; Ref 9-194), increasing the abundance of filter feeding invertebrates and mobile consumers (Ref 9-196; Ref 9-194), altering sessile assemblages (Ref 9-197) and influencing larval recruitment (Ref 9-195; Ref 9-125). For example, Pardal-Souza *et al*. (Ref 9-125) found shading to consistently affect the biological community of rocky shores, such that the biomass and cover of macroalgae, and the size of most sedentary grazers, were smaller. Additionally, in the infralittoral fringe there was a shift in dominance from macroalgae to invertebrate filter feeders (Ref 9-125). Larval recruitment was also affected, with oysters and barnacles recruiting more in shaded habitats (Ref 9-125).

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9.8.216 Changes in sunlight levels as a result of shading have the potential to cause changes to the benthic community occurring in an area. In particular, shading can reduce the amount of light available for species that perform photosynthesis such as macroalgae species (seaweeds), macrophytes (such as saltmarsh plants) and microphytobenthos.

9.8.217 The open piled approach jetty could cause some shading to intertidal mudflat habitat. Given that these structures will be located several metres above the seabed, however, some natural light would be expected to reach the mudflat from either side of these structures all times of the day with no habitat permanently shaded. Shading at the level predicted would only be expected to cause negligible changes to the growth rates of macroalgae species (seaweeds) and microphytobenthos occurring on the foreshore. Furthermore, no saltmarsh and only limited macroalgae occurs on mudflats in this area.

9.8.218 Based on the above, the magnitude of the change will be negligible. Whilst the probability of some shading is likely to be high, the overall exposure will be negligible. The sensitivity of benthic habitats and species found in the footprint to the scale of shading effects is considered to be low and thus vulnerability is considered to be none. While both the subtidal and intertidal benthic communities are commonly occurring in the region, intertidal habitats are protected and of functional importance for waterbirds. Importance is therefore considered to range from moderate (for subtidal habitats) to high (for intertidal habitats). Consequently, the overall impact is assessed as **insignificant.**

Non-native species transfer during vessel operations

General scientific context

9.8.219 Scientific evidence on this potential impact pathway has already been provided above in the construction sub-section of the impact assessment and is, therefore, not repeated here (**Paragraphs 9.8.90** to **9.8.94**).

9.8.220 Non-native species have the potential to be transported into the study area on ships' hulls during maintenance dredging and through operational vessels. Non-native invasive species also have the potential to be transported via ship ballast water. Seawater may be drawn into tanks when the ship is not carrying cargo, for stability, and expelled when it is no longer required. This provides a vector whereby organisms may be transported long distances.

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9.8.221 Piles and other artificial structures can provide suitable habitats for non-indigenous marine species and function as corridors for the expansion of these species in terms of range and distribution. However, artificial structures are widespread in the Immingham area with a wide variety of jetty structures, sea walls and sea defences available for species to colonise. On this basis, the presence of new infrastructure as a result of the Project is considered unlikely to significantly increase the rate of spread of non-native species in the area.

9.8.222 In view of current legislation (described in more detail in the assessment of non-native species during construction, **Paragraph 9.8.106**) and the fact that potential biosecurity risks are managed through ABP's existing biosecurity management procedures, the probability of the introduction and spread of non-native species from operational phase is considered to be low. However, given that the magnitude of change is unknown, magnitude ranges from negligible to large depending upon the scale and nature of any non-native species introduction, thus the exposure ranges from negligible to low at worst. The sensitivity of all intertidal and subtidal receptors to non-native species introductions is expected to range from low to moderate. Vulnerability is, therefore, considered to be low. In addition, importance is considered to range from high (for intertidal mudflats) to moderate (for subtidal habitats). The overall impact is, therefore, assessed, as **insignificant** to **minor adverse**.

Changes in air quality due to marine vessel and landside plant emissions

9.8.223 Emissions from docked marine vessels and landside plant during operation have been modelled in **Chapter 6: Air Quality** of the ES **[TR030008/APP/6.2]**. The potential for NOx, NH_3, SO_2 and N deposition to affect designated habitats that are sensitive to these emissions within the Humber Estuary EMS has been identified. The number of vessel calls during operation is anticipated to be 292 each year (average of 0.8 vessels per day); which is very small when considered in context with the baseline vessel movements within the Humber Estuary, which Department for Transport ("DfT") statistics indicate is one of the busiest waterways in the UK serving the main Humber Ports of Hull, Goole, Grimsby and Immingham; analysis of marine traffic presented within Chapter 12 (Marine Transport & Navigation) states that average daily vessel movements in this

section of the Estuary (in the one year period between September 2021 and August 2022) were 78 per day. The majority of the vessels were cargo vessels (c. 47% of movements) followed by tugs (24%), tankers (15%) and passenger vessels (5%).

9.8.224 The assessment of air quality impacts on nature conservation receptors has been informed by modelling presented in **Chapter 6: Air Quality [TR030008/APP/6.2]** and the following sections of that chapter are relevant to the assessment:

a. **Table 6-19** – presents the outcome of air quality modelling on sensitive habitat receptors in the Humber Estuary assuming that all vessels calling at the Project will conform to the MARPOL Tier III NOx emissions standard.

b. **Table 6-20** - presents the outcome of air quality modelling on sensitive habitat receptors in the Humber Estuary assuming that all vessels calling at the Project will conform to the MARPOL Tier II NOx emissions standard.

c. **Figure 6.3 [TR030008/APP/6.3]** showing the locations of the modelled receptor locations within the Humber Estuary designated site.

9.8.225 The modelling and assessment of air quality impacts has been informed by the Critical Loads and Levels for sensitive habitats within the Humber Estuary designated site for NH_3, NO_x, SO_2 and nitrogen deposition, which are published on the UK Air Pollution Information System ("APIS") database. The modelling has also taken into account The International Convention for the Prevention of Pollution from Ships ("MARPOL") standards for marine vessel NOx emissions. MARPOL Tier III is more stringent than MARPOL Tier II; in order to go from the NOx Tier II limits to the NOx Tier III limits, NOx emissions must be cut by about 75%.

9.8.226 While the '1% of the critical level/load' threshold is an important initial assessment threshold, it is not a damage threshold. Moreover, whether the critical level or load will be exceeded by total pollutant concentrations/deposition rates is also important. Modelling presented in **Table 6-19** in **Chapter 6: Air Quality [TR030008/APP/6.2]** demonstrates that with vessels complying with MARPOL Tier III emissions standards, modelled IGET sources account for 1% or less of the Critical Level for annual mean NO_X at all but two receptor locations (O_E1 and O_E2). At these two locations, total NO_X concentrations account for approximately 52% of the Critical Level (i.e. the critical level would not be exceeded). With MARPOL Tier III emissions standards, modelled IGET sources also account for 1% or less of the Critical Levels for SO_2 and NH_3 and of the Critical Load for nitrogen deposition, noting that the IAQM state that the 1% screening criteria should not be used rigidly and not to a numerical precision greater than the expression of the criteria themselves[18].

[18] '*Whilst it is straightforward to generate model results for the PC to any level of precision required, the accuracy of the result is much less certain and it is unwise to place too much emphasis on whether the PC is 0.9% or 1.1%*' (Ref 9-198)

9.8.227 Modelling presented in **Table 6-20** in **Chapter 6: Air Quality [TR030008/APP/6.2]** demonstrates that with vessels complying with MARPOL Tier II emissions standards (i.e. the less stringent standard), modelled IGET sources account for 1% or less of the Critical Level for annual mean NOX at all but three receptor locations (O_E1, O_E2 and O_E3). At these three locations, total NOX concentrations account for approximately 56% of the Critical Level (i.e. the critical level would not be exceeded). With MARPOL Tier II emissions standards, modelled Project sources account for 1% or less of the Critical Levels for SO2 and NH3. Project sources account for 1% or less of the Critical Load for nitrogen deposition at all but two receptors (O_E1 and O_E2), with an impact equivalent to 1.7% and 1.9% of the critical load respectively. At these locations, the Critical Load for nitrogen deposition is already exceeded by the background contribution alone with the Project contribution accounting for just 1.2% of the total nitrogen deposition rate predicted at these locations. Therefore, the impact of the Project on nitrogen deposition under a MARPOL Tier II emissions scenario is greater than 1% of the critical load (being approximately 2% of the critical load) at two receptor locations, and therefore is assessed in further detail below.

9.8.228 At the worst affected nature conservation receptor (O_E12, which relates to saltmarsh habitat on the northern shore of the Estuary) **(Figure 6.3 in [TR030008/APP/6.2]**), the change in annual mean NH_3 and SO_2 can be screened as insignificant in line with Environment Agency guidance as the changes do not exceed 1% of the Critical Levels for NH_3 and SO_2. However, the annual mean NOx concentration and annual N deposition rate cannot be screened as insignificant as it exceeds the 1% screening threshold.

9.8.229 For saltmarsh, APIS provides a Critical Load range of 10 - 20 kg/ha/yr and nitrogen inputs have been experimentally demonstrated to have an effect on overall species composition of saltmarsh. However, the Critical Loads on APIS are relatively generic for each habitat type and cover a wide range of deposition rates. They do not (and are not intended to) take other influences (to which the habitat on a given site may be exposed) into consideration.

9.8.230 Moreover, it is important to note from APIS that the experimental studies which underlie conclusions regarding the sensitivity of saltmarsh have *'… neither used very realistic N doses nor input methods i.e. they have relied on a single large application more representative of agricultural discharge'*, which is far in excess of anything that would be deposited from atmosphere. Therefore, APIS indicates that determining which part of the critical load range to use for saltmarsh requires expert judgment.

9.8.231 Generally, nitrogen inputs from the air are not as important to plants as nitrogen from other sources. Effects of nitrogen deposition from atmosphere are likely to be dominated by much greater impacts from marine or agricultural sources. This is reflected on APIS itself, which states regarding saltmarsh that '*Overall, N deposition [from atmosphere] is likely to be of low importance for these systems as the inputs are probably significantly below the large nutrient loadings from river and tidal inputs*'. Another mitigating factor is that the nature of intertidal saltmarsh in the Humber estuary means that there is daily flushing from tidal

incursion. This is likely to further reduce the role of nitrogen from atmosphere in controlling botanical composition.

9.8.232 The change in threshold values for critical loads in APIS has been informed by recent studies in Ireland and the Netherlands, and a collaboration under the Working Group on Effects ("WGE") of the UNECE Convention on Long-Range Transboundary Air Pollution reported by the German Environment Agency (Ref 1)-. That research has shown that position of the saltmarsh in the tidal profile is relevant to which part of the critical load range is more appropriate. This is because the less the frequency or duration of inundation by seawater, the more important atmosphere becomes as a source of nitrogen. The APIS Site Relevant Critical Load for the Humber Estuary SAC states that the lowest part of the new critical load range for upper saltmarsh (10 kg N/ha/yr) is most appropriate to the *'more densely vegetated upper marsh (e.g. EUNIS class MA223, MA224)'* with the highest part of the range being more appropriate for more frequently inundated marsh. Classes MA223 and MA224 are '*regularly but not daily flooded by seawater'* with a figure cited of 100-200 days/year (Ref 9-202).

9.8.233 There is therefore good reason to conclude that the upper part (20 kg N/ha/yr) of the critical load range is appropriate for the affected areas of saltmarsh. Therefore, the additional predicted contribution from nitrogen emissions from the Project does not result in any exceedance of the Critical Load range for saltmarsh, as the modelled annual mean deposition rate at receptor O_E12 will be 16.0 kg N/ha/yr, which is well below the 20 kg N/ha/yr upper critical load.

9.8.234 Moreover, guidance within the Highways Agency's Design Manual for Roads and Bridges (DMRB) guidance in respect of Air Quality (Ref 9-199), identifies a threshold of 0.4 kg N/ ha/ yr as resulting in 'no significant effect' on all habitats based on Natural England Research Report NECR 210 (Ref 9-200), which collated dose response research and found that the lowest additional nitrogen deposition to reduce species richness in any habitat by one species was 0.4 kg/ N/ ha/ yr. The modelled cumulative Process Contribution from the Project under the worst-case MARPOL Tier II Emissions Standards scenario is 0.2 kg/ N/ ha/ yr and therefore is well under this threshold for effecting a measurable change in vegetated habitat species diversity. Although the emissions to air arising from the Project are mainly from marine vessels, as the pollutants are the same as those assessed for road vehicle engine emissions in the DMRB, it is considered appropriate to apply this threshold in the assessment for the Project.

9.8.235 In addition, Natural England's Supplementary Advice on Conservation Objectives for the Humber Estuary SAC states that the conservation objective for the 'Atlantic salt meadows *Glauco-Puccinellietalia maritimae*' and '*Salicornia* and other annuals colonising mud and sand' habitat features relevant to the assessment of air quality effects is to "*Maintain concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature on the Air Pollution Information System*" (Ref 9-201). As set out above, the Process Contribution from the Project, which results in a mean deposition rate of 16 kg N/ ha/ yr on the nearest saltmarsh habitat does, not result in any exceedances of the Critical Load published on the APIS. Indeed, air quality modelling for this Project forecasts a slight improvement in nitrogen deposition

between the base year and 2036 even when allowing for the Project. Therefore, the Project will not compromise the air quality 'maintain' target for the Humber Estuary SAC.

9.8.236 Intertidal habitats within the Humber Estuary are considered to be of high importance due to their designated status as a qualifying feature of the Humber Estuary SAC/ SSSI, NERC listed habitat and a supporting feature of the Humber Estuary SPA. These habitats are considered to have high sensitivity to changes in air quality due to the existing high background levels of some pollutants. However, as assessed above, the probability of damage occurring due to changes in air quality as a result of the operation of the Project is negligible and the magnitude of impact is also negligible; the vulnerability of these habitats to changes in air quality is therefore none given that no pollutant impacts that would result in damage to designated habitats are predicted. Changes in air quality will not adversely affect designated intertidal or coastal terrestrial habitats within the Humber Estuary, and the effects are therefore assessed as neutral **(insignificant)**.

9.9 Mitigation and Enhancement Measures

Underwater noise and vibration on fish and marine mammals as a result of construction

9.9.1 In order to reduce the level of impact associated with underwater noise and vibration on fish and marine mammals during construction (which is assessed as minor to moderate adverse), the following mitigation measures will be implemented during marine piling.

Soft start

9.9.2 The gradual increase of marine piling power, incrementally, until full operational power is achieved will be used as part of the marine piling methodology. This will give fish and marine mammals the opportunity to move away from the area before the onset of full impact strikes. The duration of the soft start is proposed to be 20 minutes in line with the Joint Nature Conservation Committee ("JNCC") marine piling protocol (Ref 9-18).

Vibro marine piling

9.9.3 Vibro marine piling is proposed to be used where possible (which produces lower peak source noise levels than percussive marine piling) although it is recognised that impact marine piling is anticipated to always be required to reach the design depths. For the purposes of this assessment, the maximum pile driving scenario is assumed as a worst case to involve approximately 60 minutes of vibro -marine piling followed by 270 minutes of impact marine piling per day in a 12 hour shift.

Seasonal marine piling restrictions

9.9.4 During percussive marine piling the following further restrictions are proposed:

a. No percussive marine piling is to take place within the waterbody between 1 April and 31 May inclusive in any calendar year. This will minimise the potential impact on the greatest number of different migratory fish in the Humber Estuary, in accordance with the periods identified in **Table 9-16**, and also the more vulnerable earlier life stages of a number of migratory fish species[19]. This restriction does not apply to percussive marine piling that can be undertaken outside the waterbody at periods of low water[20]; and

b. The duration of percussive marine piling is to be restricted within the waterbody from 1 June to 30 June and 1 August to 31 October inclusive in any year to minimise the impacts on fish migrating through the Humber Estuary during this period such as silver eels, river lamprey and returning adult Atlantic salmon. The maximum amount of percussive marine piling permitted within any four week period must not exceed 140 hours where a single marine piling rig is in operation or a total of 196 hours where two rigs are in operation (it is assumed that up to two marine piling rigs could be pile driving at any one time). The measurement of time during each work-block described above must begin at the start of each timeframe, roll throughout it, then cease at the end, where measurement will begin again at the start of the next timeframe, such process to be repeated until the end of marine piling works. This restriction does not apply to percussive marine piling that can be undertaken outside the waterbody at periods of low water. This approach has been developed in consultation with the MMO and Cefas.

Night time marine piling restriction

9.9.5 The upstream migration of river lamprey takes place almost exclusively at night (Ref 9-57). There is also an increase in glass eel migratory activity during the night time (Ref 9-127). During the periods 1 March to 31 March, 1 June to 30 June and 1 August to 31 October inclusive, piling will be restricted at night. Specifically, no percussive piling will be undertaken from 19:00 to 07:00 in March, September and October and between sunset and sunrise in June and August. Percussive marine piling operations that have already been initiated will, however, be completed where an immediate cessation of the activity would form an unsafe working practice. This restriction does not apply to percussive marine

19 Spring is the peak period when Atlantic salmon and sea trout smolts migrate downstream to the sea and it is also the peak migration period for European eel elvers moving into the estuary. In addition, it is the period when allis shad move into estuaries and when sea lamprey and twaite shad gather in estuaries and move up to spawn. It is also the period when the highest densities of smelt are present in the Humber Estuary.

20 The force generated by marine piling outside the waterbody will be exerted on the ground at that location. The sound waves can travel outwards through the seabed or be reflected from deeper sediments. As these waves propagate, sound will also "leak" upwards contributing to the airborne sound wave. The underwater noise from marine piling outside the waterbody will, therefore, be considerably reduced (and negligible in scale) as a result of absorption of the sound by the ground and air, the interaction with the ground surface (reflection and scattering), and the interaction with and transmission through the ground.

piling that can be undertaken outside the waterbody at periods of low water which will limit the potential effects of underwater marine piling noise on the nocturnal movements of river lamprey and glass eels.

Marine Mammal Observer

9.9.6 In addition, in order to further reduce the significance of the impact to marine mammals the JNCC Statutory Nature Conservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals During Marine piling (Ref 9-18) will be followed during percussive marine piling. The key procedures highlighted in this document include the following:

a. Establishment of a 'mitigation zone' of 500m from the marine piling locations, prior to any percussive marine piling. Within this mitigation zone, observations of marine mammals will be undertaken by a trained member of the construction team using marine mammal identification resources.

b. 30 minutes prior to the commencement of percussive marine piling, a search will be undertaken by the Marine Mammal Observer to determine that no marine mammals are within the mitigation zone. Percussive marine piling activity will not be commenced if marine mammals are detected within the mitigation zone or until 20 minutes after the last visual detection.

c. During percussive marine piling, the Marine Mammal Observer will observe the mitigation zone to determine that no marine mammals are within this area. Construction workers will be alerted if marine mammals are identified, and marine piling will cease whilst any marine mammals are within the mitigation zone. Marine piling can recommence when the marine mammal exits the mitigation zone and there is no further detection after 20 minutes.

d. If there is a pause in percussive marine piling operations for any reason over an agreed period of time, then another search (and soft-start procedures for marine piling) will be repeated before activity recommences. If, however, the mitigation zone has been observed while marine piling has ceased and no marine mammals have entered the zone, marine piling activity can recommence immediately.

9.10 Assessment of Residual Effects

Construction

9.10.1 Without mitigation, the following pathways were assessed as **minor** to **moderate adverse:**

a. Underwater noise and vibration on fish as a result of marine piling.

b. Underwater noise and vibration on marine mammals as a result of marine piling.

9.10.2 With the implementation of appropriate mitigation measures, the residual effects on these receptors are considered **minor** and **not significant**.

9.10.3 All the other potential impacts on nature conservation and marine ecology receptors have been assessed as **insignificant** to **minor adverse** and, therefore, **not significant**.

Operation

9.10.4 All potential impacts on nature conservation and marine ecology receptors during operation have assessed as **insignificant** to **minor adverse** and, therefore, **not significant**.

Decommissioning

9.10.5 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on marine ecology receptors from decommissioning have been scoped out.

9.11 Summary of Assessment

9.11.1 A summary of the impact pathways that have been assessed, together with the identified residual impacts and level of confidence is presented in **Table 9-22.**

Table 9-22: Summary of potential impact, mitigation measures and residual adverse effects

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Benthic habitats and species	Direct loss of intertidal habitat as a result of the piles	Insignificant	N/A	**Insignificant**	**High:** Baseline conditions and potential impacts on benthic receptors are well understood
	Direct loss of subtidal habitat as a result of the piles	Insignificant	N/A	**Insignificant**	**High:** Baseline conditions and potential impacts on benthic receptors are well understood
	Changes to benthic habitats and species as result of the removal of seabed material during dredging	minor adverse Insignificant	N/A	**Insignificant to minor adverse**	**High:** Baseline conditions and potential impacts on benthic receptors are well understood.
	Changes to habitats and species as a result of sediment deposition during dredging and dredge disposal	Insignificant	Target disposal loads in the central/ deeper area of the disposal sites to reduce depth reductions	**Insignificant**	**Medium:** The assessment is based on site specific data, and conceptual understanding of the study area combined with physical processes modelling. The numerical model is fully calibrated, however, it is recognised that such models represent a number of complex parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved.

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
	Indirect loss or change to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes during capital dredging and dredge disposal	Insignificant	N/A	**Insignificant**	**Medium:** The assessment is based on site specific data, and conceptual understanding of the study area combined with physical processes modelling. The numerical model is fully calibrated, however, it is recognised that such models represent a number of complex parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved.
	Changes in water and sediment quality during capital dredging and dredge disposal	Insignificant	N/A	**Insignificant**	**Medium;** The assessment is based on site specific data, and conceptual understanding of the study area combined with physical processes modelling. The numerical model of SSC is fully calibrated, however, it is recognised that such models represent a number of complex parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved. The potential impacts of water quality on benthic receptors are also well understood, through a large

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
					amount of scientific evidence on this subject.
	Underwater noise and vibration effects on invertebrates during marine piling, capital dredging and dredge disposal	Insignificant	N/A	**Insignificant**	**Medium:** Assessment based on available empirical evidence of the behavioural effects of noise on invertebrates.
	Introduction and spread of non-native species	Insignificant to minor adverse	Include biosecurity control measures within the CEMP	**Insignificant to minor adverse**	**Medium:** Scientific understanding of the introduction of non-native species is generally good although some uncertainty still surrounds the level of risk associated with the introduction of species.
Fish	Direct loss or changes to fish populations and habitat as a direct result of dredging and dredge disposal	Insignificant to minor adverse	N/A	**Insignificant to minor adverse**	**Medium:** Potential impacts on fish receptors are generally well understood
	Changes in water and sediment quality as a result of dredging and dredge disposal	Insignificant	N/A	**Insignificant**	**Medium:** The assessment is based on site specific data, and conceptual understanding of the study area combined with physical processes modelling. The numerical model of SSC is fully calibrated, however, it is recognised that such models represent a number of complex

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
					parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved. The potential impacts of water quality on fish are well understood, through a large amount of scientific evidence on this subject.
	Underwater noise disturbance and vibration during marine piling, capital dredging and dredge disposal	Minor to moderate adverse (migratory fish during marine piling) Insignificant to minor adverse (other fish species during marine piling) Insignificant to minor adverse (dredge and dredge disposal)	Apply soft start procedures during marine piling Use vibro marine piling where possible Seasonal marine piling restrictions Night time working restriction	**Insignificant**	**Medium:** The underwater noise model is based on established theoretical parameters but there is limited empirical evidence of the behavioural effects of noise on fish.
Marine mammals	Underwater noise disturbance and vibration during marine piling, capital dredging and dredge disposal	Minor to moderate adverse (marine piling) Insignificant (dredge and dredge disposal)	Apply soft start procedures during marine piling Use vibro marine piling where possible Marine Mammal Observer will follow JNCC protocol to minimise the risk of	**Minor adverse**	**Medium:** The underwater noise model is based on established theoretical parameters but there is relatively limited empirical evidence of the behavioural effects of noise on marine mammals.

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
			injury to marine mammals during percussive marine piling		
Operational Phase					
Benthic habitats and species	Changes to benthic habitats and species as result of seabed removal during maintenance dredging	Insignificant to minor	N/A	**Insignificant to minor**	**High:** Baseline conditions and potential impacts on benthic receptors are well understood
	Direct changes to benthic habitats and species beneath marine infrastructure due to shading	Insignificant	N/A	**Insignificant**	**High:** Baseline conditions and potential impacts on benthic receptors are well understood
	Non-native species transfer during vessel operations	Insignificant to minor adverse	N/A	**Insignificant to minor**	**Medium:** Scientific understanding of the introduction of non-native species is generally good although some uncertainty still surrounds the level of risk associated with the introduction of species.
	Damage to sensitive habitats as a result of changes in air quality from marine vessel and landside plant emissions	Insignificant	N/A	**Insignificant**	**High** There will be no exceedances of Critical Loads/ Levels for any pollutant at sensitive habitats within the zone of influence of the Project.

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TR030008

Volume 6

6.2 Environmental Statement

Chapter 10: Ornithology

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 10: Ornithology

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

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10 Ornithology

10.1 Introduction

10.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on Ornithology.

10.1.2 There may be interrelationships related to the potential effects on Ornithology and other disciplines. Therefore, also refer to the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 7: Noise and Vibration.**

b. **Chapter 8: Nature Conservation (Terrestrial Ecology).**

c. **Chapter 9: Nature Conservation (Marine Ecology).**

d. **Chapter 16: Physical Processes.**

e. **Chapter 17: Marine Water and Sediment Quality.**

10.1.3 Relevant aspects of the ornithology assessment presented in this chapter have informed the **Water Framework Directive ("WFD") Compliance Assessment [TR030008/APP/6.4]** and the **Shadow Habitats Regulations Assessment ("HRA") [TR030008/APP/7.6]**.

10.1.4 This chapter is also supported by the following figures and appendices:

a. **Figure 10.1:** Monitoring locations of coastal waterbird surveys in the vicinity of the Project **[TR030008/APP/6.3]**.

b. **Figure 10.2:** Internationally and nationally designated conservation sites **[TR030008/APP/6.3]**.

c. **Figure 10.3:** The 5-year mean peak number of birds in Sector C during different winter months **[TR030008/APP/6.3]**.

d. **Figure 10.4:** The broad distribution of coastal waterbirds in Sector C **[TR030008/APP/6.3]**.

e. **Figure 10.5**: Predicted noise levels during marine piling **[TR030008/APP/6.3]**.

f. **Figure 10.6**: The potential disturbance buffer that has been applied to the assessment **[TR030008/APP/6.3]**.

g. **Appendix 10.A [TR030008/APP/6.4]:** Bird data for Sector C covering the period October 2021 to September 2022 and a summary of surveys undertaken on terrestrial land within the proposed development footprint to understand the potential for supporting coastal waterbird species.

10.2 Consultation and Engagement

10.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the Ornithology assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on ornithology. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

10.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

10.2.3 As a result of consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

10.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 10-1.** The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 10-1: Consultation summary table

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes to scope out this matter [direct changes to waterbird bird foraging habitat as a result of the capital dredge and dredge disposal] as the dredge and disposal sites do not overlap the intertidal area and the seabed habitat is already highly dynamic and not known to support large populations of diving birds/ seabirds. The Inspectorate agrees this matter can be scoped out of the assessment given the low value of the habitat as a prey resource.	Scoping opinion noted.
Scoping Report August 2022		In the absence of agreement with Natural England, the Inspectorate does not agree that this matter [Indirect changes to intertidal feeding and roosting habitat as a result of the capital dredging] should be scoped out of the assessment because insufficient information has been provided to conclude that no significant effects would result from the scale of predicted changes on intertidal habitats. Evidence on this should be provided in the ES to demonstrate that there will be no likely adverse significant effects.	Noted. This pathway has been scoped into the assessment.
Scoping Report August 2022		The Scoping Report states that the resuspension of sediment onto the seabed as result of piling is expected to be negligible and benthic habitats and species are not expected to be sensitive to this level of change. The Inspectorate agrees that there is unlikely to be an effect on coastal waterbird habitat and prey resources and this matter [changes to seabed habitats and species as a result of sediment deposition during piling] can therefore be scoped out of the assessment.	Scoping opinion noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022		The Scoping Report states that the presence of the piled structures has the potential to result in changes to hydrodynamic and sedimentary processes but this is anticipated to be negligible and highly localised and marine habitats and species are not expected to be sensitive to this level of change. The Inspectorate does not agree to scope out this matter [indirect changes to seabed habitats and species as a result of changes to hydrodynamic and sedimentary processes due to the presence of the piles] from the assessment until the physical processes assessment and other evidence provides sufficient evidence that there will be no significant adverse effects on marine habitats and species.	Noted. This pathway has been scoped into the assessment.
Scoping Report August 2022		The Scoping Report states that during capital dredging and dredge disposal, there is potential for the dredging vessel to cause noise and visual disturbance for bird populations but that the area is subject to high levels of vessel movements from the regular disposal of maintenance dredge arisings and shipping and that any potential disturbance stimuli caused by the capital dredge disposal would be highly temporary and localised. The Scoping Report adds that these areas are also not known to support large populations of diving birds/ seabirds. The Inspectorate does not agree this matter [noise and visual disturbance during capital dredge disposal] should be scoped from the assessment because there is insufficient evidence to conclude that the additional noise and visual disturbance would not have a significant adverse effect	Additional evidence and literature has been used to inform the assessment within this chapter and the pathway has been scoped out based on this additional information (**Table 10-17**).

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		on bird species because of noise and visual disturbance during capital dredge disposal.	
Scoping Report August 2022	Natural England	Bird survey data is required which covers the full period when significant numbers of birds are likely to be using the site, in order to inform a thorough assessment of the potential impacts of the development. As the surveys which relate to Immingham Outer Harbour cover the period October to March this will not cover the passage periods, in particular, we know that the Autumn passage period (August and September) is likely to be significant for SPA birds in this part of the estuary. In addition, bird data will be required which covers the low tide period as well as the high tide period, in order to have sufficient data to assess the construction and operational effects of the Project. It is not currently clear if this is the case for the data from Immingham Outer Harbour. Therefore additional bird surveys are likely to be required which cover the passage periods (particularly August and September) and potentially the low tide period.	Terrestrial waterbird survey scope covers the passage period, with surveys being undertaken twice monthly at High Water between September 2022 and March 2023 inclusive. The coastal waterbird surveys started in winter 1997/98 and have been ongoing annually since then with winter surveys undertaken between October and March twice a month. During each survey, either four counts (November to February) or five counts (other months) are undertaken every two hours after high water. The most recent five-years of data (2018/19 to 2022/23) has been analysed. In addition, the 2021/22 survey season started in August rather than October. The surveys have been continued on a monthly basis throughout 2022 rather than stopping in March as per previous years. Surveys are therefore undertaken during both high and low water periods with data available for both winter and passage months.
Scoping Report August 2022		Changes to intertidal feeding and roosting habitat at whatever scale need to be quantified, Natural England seek clarification on the justification for scoping this impact out of EIA. Additional noise will disturb local bird populations. Natural England have not seen the bird surveys mentioned in para 9.3.3 of the scoping report but these along with additional surveys programmed will indicate the level of disturbance on notified bird populations.	Noted. All potential pathways relating to intertidal habitat loss or change have been scoped into the assessment.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022		Per section 9.4.7 of the scoping report, [Operation - pathways scoped out].- Natural England seeks clarification on this comment ['No pathways during the operational phase are proposed to be scoped out of the EIA'], does this mean that all impacts scoped in during the construction phase are also scoped in during the operational phase?	Only the pathways that are scoped in under operation will be considered. No other relevant pathways have been identified.
Scoping Report August 2022		Again Natural England welcome the commitment to consult all statutory bodies.	Noted.
Statutory Consultation January 2023	Natural England	**Chapter 10: Ornithology** **Potential Impacts on Greater Wash SPA** Your assessment concludes that the proposal can be screened out from further stages of assessment because significant effects are unlikely to occur, either alone or in combination. On the basis of the information provided, Natural England concurs with this view.	Noted.
	Natural England	**Key points in relation to Humber Estuary SPA/ Ramsar birds** Associated British Ports (ABP) has collected bird data for bird survey Sector C of Immingham frontage for October to March inclusive for several years. In relation to this development, data has been collected for August and September 2021 and April to August 2022. Natural England advises that the data for winter and summer bird counts for 2021 and 2022 should be combined to give a complete picture of bird activity throughout these years. We understand that bird data is being collected	1). Noted. 2). Relevant tables and figures have been updated (including winter 2022/23 data) within this chapter. The source of the data has been highlighted in the respective tables or figures. In addition, **Appendix 10.A [TR030008/APP/6.3]** includes both winter and passage months so counts through the year are presented. 3). More detailed assessment based on the data has been undertaken including identifying those months that have significant numbers of Special Protection Areas ("SPA")/ Ramsar species (over 1% of the latest estuary-wide Wetland Bird Survey ("WeBS") five-year mean peak).

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		for terrestrial fields adjacent to the Humber Estuary to assess their value as functionally linked land. • Once the additional bird data is available, the relevant tables and figures (including figures 10.3 and 10.4 which relate to bird data within bird survey sector C of Immingham frontage) need to be updated so that we have a more complete picture of bird use on the site. Please also indicate clearly the sources of data for each figure/ table, whether it is Wetland Bird Survey (WeBS) or ABP's own data. • Once additional data is available, more detailed assessment of the data is needed, including identification of the months that have significant numbers of SPA/ Ramsar species (over 1% of the latest WeBS five-year mean peak) and identification of the key species. This information is currently presented as data for October to March winter period (Table 10.7) and data for months outside October to March winter period (Table 10.8) • More information about mitigation measures will be required if significant numbers of birds are recorded. The HRA should also explain how the mitigation measures proposed will avoid or reduce the effect and the level of certainty that mitigation measures will be effective. • The intertidal areas adjacent to proposed jetty and the terrestrial habitat are likely to be the areas with the highest potential for impacts on SPA/Ramsar birds.	4). Mitigation requirements for coastal waterbirds have been developed based on the bird survey results and as part of the assessment process (including the HRA) and through engagement with statutory authorities. These are provided in **Section 10.9.** 5). Noted.
	Natural England	**Natural England's response refers to the following tables:**	Noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Table 10.10 Potential effects during construction scoped in/ out of further detailed assessment In terms of construction impacts, we consider that this table equates to the likely significant effect test in the HRA for effects on SPA/ Ramsar birds during the construction period. Natural England agrees that maintenance dredging and dredge disposal is unlikely to impact SPA/ Ramsar birds due to the distance of the berth from any intertidal habitat. The assessment of impacts on SPA/ Ramsar birds during the construction period will be informed by the additional bird data and analysis of this data. Natural England will provide advice on the outputs of the assessments once the additional information is available.	
	Natural England	**Table 10.11 Potential effects during operation scoped in/ out of further detailed assessment (berth operations during operation phase)** The following impacts have been screened in for further assessment and Natural England supports this approach. • Direct changes to intertidal foraging and roosting habitat as a result of marine infrastructure footprint. • Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats. • Airborne noise and visual disturbance to waterbirds using terrestrial habitats. The assessment of impacts on SPA/ Ramsar birds during the operational period will be informed by the additional bird data and analysis of this data. Natural England will provide advice on the outputs of the	Noted.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		assessments once the additional information is available.	
	Natural England	**Table 10.12 Summary of potential impact, mitigation, and residual effects** We cannot comment on this table until all the bird data is available, the HRA has been carried out and we better understand the expected impacts and what mitigation measures are required.	Noted.
	Natural England	Below is a summary of the expected scenarios/ locations for disturbance of SPA/ Ramsar birds during construction and operation phases. We have highlighted any additional issues that we advise should be considered in the assessment: 1) Disturbance to birds during construction in the marine environment (Table 10.10) Natural England supports the use of the 300m disturbance zone for birds. Mitigation measures such as soft start piling, and cold weather restrictions have been mentioned. However, the HRA should look in detail at the impacts of the development on SPA/ Ramsar birds and identify what/why mitigation measures will be required. The Environment Agency has implemented seasonal working restrictions for the Stallingborough 3 flood alleviation scheme (avoiding working during the winter months), so this will be a consideration.	Based on a detailed review (presented in **Section 10.8**), the assessment has been based on the application of a 200m disturbance zone rather than 300m as the evidence suggests the response of waterbirds to disturbance stimuli is relatively limited at distances over 200m, particularly in areas subject to already high levels of existing anthropogenic activity (as found in the Port). The assessment has also been based on Natural England advice provided as part of the consultation for the nearby IERRT project which stated that '*peak levels below 55 dBA can be regarded as not significant, while peak noise levels approaching 70 dBA and greater are most likely to cause an adverse effect. Therefore, levels over 65.5 dBA may cause disturbance to SPA birds. Birds may habituate to regular noise below 70 dBA, but irregular noise above 50 dBA should be avoided'*. It should be noted that noise modelling of marine piling (i.e. in subtidal and intertidal) predicts that noise levels will be lower than 70 dBA at distances of more than 200m away with the use of a noise suppression system and also in the range of background noise levels that can occur on the foreshore in the Port of Immingham area. Mitigation requirements for coastal waterbirds have been developed based on the bird survey

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
			results and as part of the assessment process (including the HRA) and through engagement with statutory authorities. These are provided in **Section 10.9**.
	Natural England	3) Disturbance to birds during operation in the marine environment (Table 10.11) Most impacts on birds in the marine environment during operation have been screened out and given the distance of the berthing operations for the intertidal area, Natural England agrees with this assessment. However, further information is needed about the impact on birds using the intertidal areas within 300m of the new port infrastructure (jetty).	Noted. More detailed information has been provided on bird numbers in proximity to the new port infrastructure (**Section 10.8**).
	Natural England	4) Disturbance to birds during operation in terrestrial environment (Table 10.11) The fields adjacent to the estuary where the site compounds will be temporarily located have been scoped into the assessment, this is supported by Natural England. Natural England has based its advice on the fact that the construction compounds will have been removed by the start of the operational phase, however clarity about this and the expected length of the construction period will be important. There may be other fields that will be part of the development that could be used by SPA/ Ramsar birds and should also be included in the assessment. It is stated that the flood bank and the Long Strip plantation will both have a screening effect for birds using the fields adjacent to the estuary. However, as works are proposed on the plantation as part of the	This chapter has considered the other fields as part of the Project and the effects of the tree works on the screening function has also been considered. This is covered in **Section 10.8**. Wintering bird surveys have not recorded any SPA/ Ramsar species in terrestrial habitats >1% of the Humber Estuary populations, and therefore no land within the terrestrial part of the Site meets the threshold for functionally linked land.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		development, the effect of the tree works on the screening function needs to be considered.	
	Natural England	5) Loss of supporting marine habitat for SPA/ Ramsar birds (Table 10.10) Natural England agrees that the impacts from capital dredge and dredge disposal and indirect effects on estuarine processes can be screened out of further assessment within the ES, but they should be considered in the HRA. Changes to intertidal habitat from berth operation and infrastructure effects have been screened in for further assessment, Natural England supports this approach. The HRA should consider whether the same numbers and species of SPA/ Ramsar waterbirds are likely to use the site post construction. No mitigation measures have been proposed so far, however the requirement for mitigation measures will be determined through the HRA process.	Capital dredge and dredge disposal have been considered in the **Shadow HRA [TR030008/APP/7.6]** in context of supporting habitat for SPA/ Ramsar birds. Changes to waterbird habitat as a result of infrastructure has been considered in the **Shadow HRA [TR030008/APP/7.6].**
		6) Loss of supporting terrestrial habitat for SPA/ Ramsar birds (Table 10.10) Loss of habitat is screened in for further assessment, which Natural England supports. The bird data that is currently being gathered will inform the detailed assessment. The HRA should indicate the period over which the terrestrial habitat will be unavailable due to construction compounds and other uses. Natural England has been working with North East Lincolnshire Council and other estuary stakeholders for many years to deliver a strategic approach to mitigation	Wintering bird surveys undertaken in 2022/23 have not recorded any SPA/Ramsar waterbird species in numbers >1% of the Humber Estuary populations in terrestrial habitats, and therefore no land meets the threshold for functionally linked land **(Paragraphs 10.6.42 – 10.6.44**). This pathway has therefore been scoped out of the impact assessment in this Chapter and is also screened out of the **Shadow HRA [TR030008/APP/7.6]** at the Likely Significant Effects ("LSE") screening stage. Policy 9 therefore does not apply to this Project.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		within the South Humber Gateway (for impacts associated with the loss of land functionally linked to the Humber Estuary SPA/Ramsar site). Natural England believes this is the most effective way to mitigate for impacts on functionally linked land. We therefore support the commitment to further discussion with North East Lincolnshire Council with respect to the South Humber Gateway Mitigation scheme. As the proposed development site falls within the South Humber Bank mitigation zone, you should liaise with North East Lincolnshire Council regarding how you should contribute to the strategic approach. This forms a key policy in the North East Lincolnshire local plan (see policy 9 https://www.nelincs.gov.uk/assets/uploads/2020/10/The-NEL-Local-Plan-adopted-2018.pdf).	
Pre-application meeting, 23 November 2022.	Natural England	The meeting provided an update of the IGET project, a summary of the future site-specific surveys and a high-level discussion of potential effects.	This chapter and the **Shadow HRA** (**[TR030008/APP/7.6]**) have been completed taking on board consultee comments from the meeting.
Pre-application meeting, 11 January 2023	Natural England	The meeting provided a further update of the Project as well as a discussion on potential effects, HRA, stakeholder engagement and project programme.	This chapter and the **Shadow HRA** (**[TR030008/APP/7.6]**) have been completed taking on board consultee comments from the meeting.
Pre-application meeting, 01 August 2023.	Natural England	The meeting provided a further update of the Project as well as a discussion on potential effects, HRA, stakeholder engagement and project programme.	This chapter and the **Shadow HRA ([TR030008/APP/7.6])** have been completed taking on board consultee comments from the meeting.
Second Statutory Consultation	Natural England	**Internationally and nationally designated sites**	A **Shadow HRA** has been produced **[TR030008/APP/7.6]** which considers potential effects on the Humber Estuary SAC, SPA and Ramsar site.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Natural England notes there have been no amendments to the PEIR Appendix 9C which was provided in the first S42 consultation. The application site is in close proximity to European designated sites (also referred to as Habitat sites), and therefore has the potential to affect their interest features. European sites are afforded protection under the Conservation of Habitats and Species Regulations 2017, as amended (the 'Habitats Regulations'). The application site is within and adjacent to the Humber Estuary Special Area of Conservation (SAC) and Special Protection Area (SPA) which are European sites. The site is also listed as Humber Estuary Ramsar site and notified at a national level as Humber Estuary Site of Special Scientific Interest (SSSI). Our advice regarding the potential impacts upon the Humber Estuary SSSI coincides with our advice regarding potential impacts upon the Humber Estuary SAC/SPA/Ramsar as detailed above. Natural England notes that the application site is in close proximity to the Humber Estuary SSSI and North Killingholme Haven Pits SSSI. Based on the plans submitted, Natural England considers that the proposed development could have potential significant effects on the interest features for which the sites have been notified. The consultation documents provide some screening information for the Habitats Regulations Assessment (HRA). It is Natural England's advice that the proposal is not directly connected with or necessary for the management of the European site. You should therefore determine whether the proposal is likely to have a	Marine ecology features of Humber Estuary Site of Special Scientific Interest ("SSSI") are considered in Section 9.8 of **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and ornithology features of the SSSIin **Section 10.8** of this chapter. Potential effects on the North Killingholme Haven Pits SSSI are considered in**Section 10.8** of this chapter.

Reference/date	Consultee	Summary of Response	How comments have been addressed in this chapter
		significant effect on any European site, proceeding to the Appropriate Assessment stage where significant effects cannot be ruled out.	

10.2.5 Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) has also confirmed the Applicant's view that significant effects on waterbird foraging habitat from dredging and disposal activities; and seabed habitats and species as a result of sediment deposition during marine piling are unlikely. Accordingly, these matters have remained scoped out of consideration in the Environmental Statement ("ES").

10.3 Legislation, Policy and Guidance

10.3.1 **Table 10-2** presents the legislation, policy and guidance relevant to the Ornithology assessment and details how their requirements will be met.

Table 10-2: Relevant legislation, policy and guidance regarding Ornithology

Legislation/Policy/Guidance	Consideration within the ES
Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('The Habitats Directive') (Ref 10-4)	
The Habitats Directive (92/43/EEC) is intended to help maintain biodiversity throughout the EU Member States by defining a common framework for the conservation of wild plants, animals and habitats of community interest. It established a network of Special Areas of Conservation ("SAC") designated by Member States to conserve habitats and species (listed in Annexes I and II).	The Humber Estuary SAC and features are described in **Section 10.6**. Consideration of impacts on SAC habitats and potential indirect impacts on coastal waterbirds is provided in **Section 10.8**. A **Shadow Habitats Regulations Assessment [TR030008/APP/7.6]** has been produced.
Council Directive 2009/147/EC on the conservation of wild birds ('The Birds Directive') (Ref 10-5)	
Directive 2009/147/EC on the conservation of wild birds is known as the 'Birds Directive'. It creates a comprehensive scheme of protection for all wild bird species. The Directive recognises that habitat loss and degradation are the most serious threats to the conservation of wild birds. It, therefore, places great emphasis on the protection of habitats for endangered as well as migratory species (listed in Annex I), especially through the establishment of a coherent network of Special Protection Areas ("SPAs") comprising all the most suitable territories for these species.	The Humber Estuary SPA and qualifying features are described in **Section 10.6**. Consideration of impacts on coastal waterbirds which are features of the SPA are outlined in **Section 10.8**. A **Shadow Habitats Regulations Assessment [TR030008/APP/7.6]** has been produced.
Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. (Ref 10-6)	
The Water Framework Directive (2000/60/EEC) ("WFD") establishes a framework for the management and protection of Europe's water resources. The overall objectives of the WFD is to achieve *"good ecological and good chemical status*" in all	The Project (and associated disposal sites) is located within the Humber Lower water body (ID: GB530402609201) (further described in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**). A **WFD Compliance Assessment [TR030008/APP/6.4]** has been

Legislation/Policy/Guidance	Consideration within the ES
inland and coastal waters by 2021 unless alternative objectives are set or there are grounds for time limited derogation. For example, where pressures preclude the achievement of good status (e.g. navigation, coastal defence) in heavily modified water bodies ("HMWB"s), the WFD provides that an alternative objective of "good ecological potential" is set.	prepared to support the Development Consent Order ("DCO") application.
Conservation of Habitats and Species Regulations 2017 as amended ('The Habitats Regulations') (Ref 10-7)	
The Habitats Directive and Birds Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2017 as amended, known as the "Habitats Regulations"[1]. The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European Sites. The Regulations also require the compilation and maintenance of a register of European sites, to include SACs (classified under the Habitats Directive) and SPAs (classified under the Birds Directive). These sites form the Natura 2000 network. These regulations also apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), candidate SACs ("cSAC"), potential Special Protection Areas ("pSPA"), and proposed and existing European offshore marine sites.	**Section 10.6** identifies protected coastal waterbird species. Consideration of impacts on these receptors are described in **Section 10.8**. Information to support a **Shadow HRA [TR030008/APP/7.6]** has been produced. This report will inform the consultation process and will aid the Competent Authority[2] in determining whether the Project would give rise to a LSE on the interest features and/or supporting habitat of a European/Ramsar site either alone or in-combination with other plans, projects and activities and, if so, will inform the requirement to undertake an Appropriate Assessment ("AA") and the completion of the AA of the implications of the proposals in light of the site's conservation objectives.
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 as amended (Ref 10-9)	
The Water Framework Directive (2000/60/EEC) is transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 as amended, known as the Water Framework Regulations[3].	The Project (and associated disposal sites) is located within the Humber Lower water body (ID: GB530402609201) (further described in **Chapter 17: Marine Water and Sediment Quality)**. A **WFD Compliance Assessment [TR030008/APP/6.4]** has been prepared to support the DCO application.

1 Following the UK leaving the EU, the Conservation of Habitats and Species Regulations 2017 have been modified by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. Available at: https://www.legislation.gov.uk/uksi/2019/579/contents/made (accessed October 2021) (Ref 10-8).

2 The Secretary of State is the Competent Authority for the HRA for the DCO Application under the UK Habitats Regulations.

3 Following the UK leaving the EU, the main provisions of the WFD have been retained in English law through The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019 (Ref 10-11).

Legislation/Policy/Guidance	Consideration within the ES
Marine and Coastal Access Act 2009 ("MCAA") (Ref 10-10)	
The MCAA provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment. The MCAA established the Marine Management Organisation ("MMO") as the organisation responsible for marine planning and licensing. The Project will require a Marine Licence for the elements of the works below Mean High Water Springs including dredging, disposal and placing or removing objects on or from the seabed. For Nationally Significant Infrastructure Projects ("NSIPs") the DCO where granted may include provision deeming a marine licence to have been issued under Part 4 of the Marine and Coastal Access Act 2009. The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO.	Information relevant to the marine licensing process is provided in the ES including characterisation of the ornithology baseline (**Section 10.6**) and an assessment of impacts (**Section 10.8**).
The Planning Act 2008 ("2008 Act") (Ref 10-12)	
Whilst the MCAA regulates marine licensing for works at sea, section 149A of the Planning Act 2008 enables an applicant for a DCO to include within the Order a Marine Licence which is deemed to be granted under the provisions of the MCAA.	Information relevant to the marine licensing process is provided in the ES including characterisation of the ornithology baseline (**Section 10.6**) and an assessment of impacts (**Section 10.8**).
The Wildlife and Countryside Act 1981 ("WCA") (Ref 10-13)	
The WCA is the principal mechanism for the legislative protection of wildlife in Great Britain. The WCA is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention), the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Birds Directive (79/409/EEC) and the Natural Habitats and Wild Fauna and Flora Directive (92/43/FFC) are implemented in Great Britain. The WCA applies to the terrestrial environment and inshore waters (0 to 12 nautical miles) and concerns the protection of wild animals and the designation of protected areas, including SSSIs.	**Section 10.6** identifies coastal waterbird species and supporting habitats which are protected under the WCA. Consideration of impacts on these receptors is provided in **Section 10.8**.

Legislation/Policy/Guidance	Consideration within the ES
The Countryside and Rights of Way Act 2000 ("CroW Act") (Ref 10-14)	
The CroW Act applies to England and Wales only. Part III of the CroW Act deals specifically with wildlife protection and nature conservation. The CroW Act places a duty on the Government to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity. Schedule 9 of the CroW Act amends the SSSI provisions of the WCA, including increased powers for the protection and management of SSSIs. The provisions extend powers for entering into management agreements; place a duty on public bodies to further the conservation and enhancement of SSSIs; increase penalties on conviction where the provisions are breached; and include an offence whereby third parties can be convicted for damaging SSSIs.	Consideration of impacts on coastal waterbird species and assemblages, for which SSSIs have been designated, are presented in **Section 10.8**.
Natural Environment and Rural Communities Act 2006 ("NERC Act") (Ref 10-15)	
The NERC Act came into force in October 2006. In addition to establishing Natural England ("NE") as the body responsible for conserving, enhancing, and managing England's natural environment, the Act also made amendments to both the Wildlife and Countryside Act 1981 and the CroW Act 2000. For example, it extended the CroW Act's biodiversity duty to public bodies and statutory undertakers, and altered enforcement powers in connection with wildlife prosecution. In addition to this, the NERC Act contains a number of additional measures designed to help streamline delivery and simplify the legislative framework, such as changes to the remit and constitution of the Joint Nature Conservation Committee ("JNCC"), reconstitution of the Inland Waterways Amenity Advisory Council, and improving the governance arrangements for the National Parks. Section 41 of the NERC Act requires the SoS to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with NE, as required by the NERC Act.	Consideration of impacts to coastal waterbird species and supporting habitats which are protected under the NERC Act (priority species and habitats of principal importance) are presented in **Section 10.8**.

Legislation/Policy/Guidance	Consideration within the ES
National Policy Statement for Ports ("NPSfP") (Ref 10-16)	
The National Policy Statement for Ports provides the framework for decisions on proposals for new harbour facility developments that constitute an NSIP. This policy requires that in order to meet the requirements of the Government's policies on sustainable development, new port infrastructure should also, amongst other things, preserve, protect and where possible improve marine and terrestrial biodiversity, be adapted to the impacts of climate change and provide high standards of protection for the natural environment. As highlighted in paragraphs 5.1.4 and 5.1.5 of the NPSfP, where the development is subject to Environmental Impact Assessment ("EIA"), the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. As highlighted in paragraphs 5.1.8 and 5.1.9 of the NPSfP, developments should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. They should also ensure that appropriate weight is attached to designated sites of international, national and local importance.	Consideration of impacts to coastal waterbird species and supporting habitats including those which are features of internationally, nationally and locally designated sites of ecological importance are presented in **Section 10.8**. Where appropriate, mitigation has been included and this is outlined in **Section 10.7** and **10.9**.
UK Marine Policy Statement (Ref 10-17)	
The UK Marine Policy Statement ("MPS") is the framework for preparing marine plans and taking decisions affecting the marine environment. The MPS also sets out the general environmental, social and economic considerations that need to be taken into account in marine planning and provides guidance on the pressures and impacts that decision makers need to consider when planning for and permitting development in the UK marine areas. Paragraphs 3.1.7 and 3.1.8 of the MPS are relevant to the ecology assessment of the Project which, amongst other things, state that: *"Marine plan authorities and decision makers should take account of how developments will impact on the aim to halt biodiversity loss and the legal obligations relating to all MPAs, their*	Consideration of impacts to coastal waterbird species and supporting habitats including those which are features of Marine Protection Areas ("MPAs") are presented in **Section 10.8**.

Legislation/Policy/Guidance	Consideration within the ES
conservation objectives, and their management arrangements…" Marine plan authorities and decision-makers should take account of the regime for MPAs and comply with obligations imposed in respect of them. This includes the obligation to ensure that the exercise of certain functions contribute to, or at least do not hinder, the achievement of the objectives of a Marine Conservation Zone ("MCZ"). This would also include the obligations in relevant legislation relating to SSSIs and sites designated under the Birds and Habitats Directives.	
East Inshore and East Offshore Marine Plans (Ref 10-18)	
The East Inshore and East Offshore Marine Plans, which are collectively referred to as 'the East Marine Plans', were formally adopted on 2 April 2014. There are four policies within the East Marine Plans specifically related to nature conservation and ornithology.	Provides general guidance. See considerations of specific policies below.
Policy ECO1 - Cumulative impacts affecting the ecosystem of the East Marine Plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation:	Information on the cumulative and in-combination effects assessment for the Project are included in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.
Policy BIO1 - Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence on those habitats and species that are protected or of conservation concern in the East Marine Plans and adjacent areas (marine, terrestrial).	Consideration of impacts to coastal waterbird species and supporting habitats are presented in **Section 10.8**.
Policy BIO2 **-** Where appropriate, proposals for development should incorporate features that enhance biodiversity and geological interests.	Consideration of design, mitigation and enhancement measures is outlined in **Section 10.7** and **10.9**.
Policy MPA1 - Any impacts on the overall MPA network must be taken into account in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network:	Consideration of impacts to coastal waterbird species and supporting habitats are presented in **Section 10.8**. A **Shadow Habitats Regulations Assessment** has been produced **[TR030008/APP/7.6]**). MCZs are considered in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**.
North East Lincolnshire Local Plan 2013 to 2032 (Ref 10-19)	
The North East Lincolnshire Local Plan was adopted in 2018 and covers the period 2013 to 2032. Policy 7 of the plan highlights that for	Consideration of impacts to coastal waterbird species and supporting habitats and designated sites are presented in **Section 10.8**. A **Shadow**

Legislation/Policy/Guidance	Consideration within the ES
operational port areas *"proposals for port related use will be supported and, where appropriate, approved by the Council if the submitted scheme accords with the development plan as a whole and subject to the ability to satisfy the requirements of the Habitats Regulations."* In addition, Policy 41 of the plan states that: *"The Council will have regard to biodiversity and geodiversity when considering development proposals, seeking specifically to:* *A. establish and secure appropriate management of long-term mitigation areas within the Estuary Employment Zone, managed specifically to protect the integrity of the internationally important biodiversity sites (see Policy 9 'Habitat Mitigation - South Humber Bank');* *B. designate Local Wildlife Sites (LWSs) and Local Geological Sites (LGSs) in recognition of particular wildlife and geological value;* *C. protect manage and enhance international, national and local sites of biological and geological conservation importance, having regard to the hierarchy of designated sites, and the need for appropriate buffer zones;* *D. minimise the loss of biodiversity features, or where loss is unavoidable and justified ensure appropriate mitigation and compensation measures are provided;* *E. create opportunities to retain, protect, restore and enhance features of biodiversity value, including priority habitats and species; and,* *F. take opportunities to retain, protect and restore the connectivity between components of the Borough's ecological network.* *Any development which would, either individually or cumulatively, result in significant harm to biodiversity which cannot be avoided, adequately mitigated or as a last resort compensated for, will be refused".* Policy 9 has been specifically developed to provide a method by which strategic mitigation can be delivered within the region for the loss of functionally linked land (i.e. terrestrial land outside the boundary of the Humber Estuary SPA/ Ramsar but which provides an important high tide feeding, roosting and loafing resource to support wintering waterbirds within the SPA/ Ramsar). Where development within the Mitigation Zone	**Habitats Regulation Assessment [TR030008/APP/7.6]** has been produced. Policy 9 does not apply to the Project given that no functionally linked land has been identified within the Site boundary.

Legislation/Policy/Guidance	Consideration within the ES
identified on the Policies Map results in the loss of functionally linked land, payment can be made (using the calculation within the Local Plan document) into the North East Lincolnshire South Humber Gateway Ecological Mitigation Delivery Plan.	

10.4 Assessment Methodology

10.4.1 To facilitate the impact assessment process and ensure consistency in the approach to assessing significance, a standard assessment methodology has been applied to determine the significance of effects within this chapter. This methodology has been developed from a range of sources, including relevant EIA Regulations, the EIA Directive (2014/52/EU), statutory and non-statutory guidance, consultations and professional project experience. The assessment also follows the principles of relevant guidance, including the latest guidelines from the Institute of Environmental Management and Assessment ("IEMA") (Ref 10-2), and the Chartered Institute of Ecology and Environmental Management ("CIEEM") guidelines for ecological impact assessment in the UK and Ireland (which combine advice for terrestrial, freshwater and coastal environments) (Ref 10-3). The methodology adopted is considered to be 'best practice'.

10.4.2 The environmental issues have been divided into distinct 'receiving environments' or 'receptors'. The effect of the Project on each of these has been assessed by describing in turn:

a. The baseline environmental conditions of each receiving environment or receptor.

b. The 'impact pathways' by which those receptors could be affected.

c. The significance of the effect occurring as a result of the impact.

d. The measures to mitigate for significant adverse effects where these are predicted.

10.4.3 In accordance with CIEEM (Ref 10-3), an impact is defined as an action resulting in changes to an ecological feature (e.g., construction activities resulting in the direct loss of intertidal habitat) and an effect is the outcome to an ecological feature from an impact (e.g., the effects on waterbirds from the loss of intertidal habitat).

Magnitude of impacts

10.4.4 The first stage in the assessment of impact involves understanding the impact magnitude which is determined by predicting the scale of any potential change in baseline conditions.

10.4.5 Magnitude of change needs to be considered in spatial and temporal terms (including duration, frequency and seasonality), and against background environmental conditions in a study area. The assessment of magnitude should also be carried out taking account of any embedded and standard design mitigation.

10.4.6 The following criteria have been used to assess the magnitude of impact **(Table 10-6)**:

a. Negligible: Changes that are barely discernible from existing baseline conditions.

b. Small: Relatively localised changes that are often temporary in nature and/or a receptor has limited exposure to change.

c. Medium: Receptors are subject to changes that occur over a large spatial area, but the effects are considered temporary.

d. Large: Receptors are subject to changes over a large spatial area with effects that are considered permanent/long-term duration.

10.4.7 Once a magnitude has been assessed, this is then considered in terms of the probability of occurrence (i.e., likelihood that the impact will occur) to derive an overall level of exposure to change.

Sensitivity of receptors

10.4.8 Sensitivity can be described as the intolerance of a habitat, community or individual of a species to an environmental change and essentially considers the response characteristic of the feature. The sensitivity of a marine habitat or species is considered to be a product of the following (Ref 10-80):

a. The likelihood of damage (termed intolerance or resistance) due to a pressure. This could include behavioural effects, physiological damage or even mortality of individuals or populations.

b. The rate of (or time taken for) recovery (termed recoverability, or resilience) of marine species once the pressure has abated or been removed.

10.4.9 The following criteria have been used to assess sensitivity:

a. Low: Pressures in which the likelihood of damage to individuals or populations is low with recoverability expected to occur over short timescales.

b. Moderate: Pressures in which damage to individuals or populations could occur but recoverability is expected to occur over short to moderate timescales.

c. High: Pressures in which damage to individuals or populations is highly likely with either no recoverability or recoverability expected to occur over longer timescales.

10.4.10 **Table 10-3** summarises the sensitivity level that has been assigned to different receptors considered in this assessment based on consideration of the criteria highlighted above. Further rationale for the sensitivity levels that have been assigned are included for each pathway in the impact assessment.

Table 10-3: Assessed sensitivity of ornithology receptors

Receptor	Sensitivity
Coastal waterbirds	Coastal waterbirds are generally considered to have a **low** sensitivity to marine habitat change/loss on the scale predicted for the Project (due to the high mobility of the species in the study area). The species in the study area are considered to have a **low to high** sensitivity to noise and visual disturbance (depending on the species) and **moderate** sensitivity to changes in feeding and roosting habitat as a result of the presence of marine infrastructure on the scale predicted.

Receptor importance

10.4.11 In considering the magnitude of impacts and sensitivity of the receptor, it is also necessary to identify whether an ecological feature is 'important'. As such, where possible, habitats, species and their populations have been valued on the basis of a combination of their conservation status, rarity and ecological/socioeconomic value using contextual information.

10.4.12 The CIEEM (Ref 10-3) guidelines recognise that determining ecological importance is a complex process, which is a matter of professional judgement guided by the importance and relevance of a number of factors. These include designation and legislative protection as well as biodiversity value and secondary/supporting value (e.g. where habitats may function as a buffer or resource associated with an adjacent designated area).

10.4.13 The importance of each ecological receptor has been determined, based on the following criteria:

a. Low: The receptor is neither protected nor designated and is considered to be of low to moderate biodiversity or supporting value.

b. Medium: Statutory protection/designation is afforded to a receptor but it is considered to be of low to moderate biodiversity/supporting value or the receptor does not receive statutory protection but is considered to be of high biodiversity or supporting value.

c. High: Statutory protection/designation is afforded to a receptor and the receptor is considered to be of high biodiversity or supporting value.

10.4.14 The importance of a receptor has also been considered with regard to the marine geographic frame of reference defined below as recommended in the CIEEM (Ref 10-3) guidelines:

a. International and European

b. National

c. Regional (Humber Estuary)

d. Local (Port of Immingham area).

10.4.15 **Table 10-4** summarises the importance level that has been assigned to the different receptors that have been assessed based on the criteria highlighted above.

Table 10-4: Assessment of the importance of ornithology receptors

Receptor	Importance
Coastal waterbirds	**High** (international) importance: All species are of conservation interest and protected.

Significance criteria

10.4.16 Determination of the significance of the predicted ecological effects is based on professional judgement having regard to the positive (beneficial) or negative (adverse) nature of a potential impact.

10.4.17 In summary, to assess the significance of effects, the magnitude of the impact pathway and the probability of it occurring is evaluated to understand the exposure to change. This is then assessed against the sensitivity of a receptor/ feature to understand its vulnerability. Finally, this is considered in the context of the importance of a receptor/feature to generate a level of significance for effects resulting from each impact pathway.

10.4.18 The CIEEM (Ref 10-3) guidelines state that an effect should be determined as being significant when it "*either supports or undermines biodiversity conservation objectives for important ecological features"*. This guidance relates to the weight that should be afforded to effects when decisions are made, and to the consequences, in terms of legislation, policy and / or development control. A significant adverse effect on a feature of importance (as defined in **Table 10-4** would, therefore, be likely to generate the need for development control mechanisms, such as DCO Protective Provisions or Requirements.

10.4.19 Whilst this assessment adopts an Ecological Impact Assessment ("EcIA") approach and, therefore, expresses the significance of ecological effects with reference to a geographic frame of reference (as advocated in the CIEEM Guidelines, Ref 10-3), significance is also expressed using generic EIA significance criteria. The generic criteria used throughout this report is based on an expression of severity, to describe the significance of environmental impacts. For ease of reference, **Table 10-5** provides a means of relating the two approaches and is provided in order to allow the EcIA to be integrated into the wider EIA framework without compromising the CIEEM best practice approach.

10.4.20 To ensure transparency in the impact assessment, it is important to make clear the evidence-based or value-based judgments used at each stage of the assessment and how they have been attributed a level of significance. This is presented in the impact assessment for each impact pathway.

10.4.21 Following the significance assessment, a confidence assessment was undertaken which recognises the degree of interpretation and professional judgement applied. This is presented in the summary table contained within the conclusions section of this chapter (**Section 10.11**). Confidence was assessed on a scale incorporating three values: low, medium and high.

10.4.22 As shown in **Table 10-5**, effects that are identified as being moderate or major adverse/beneficial are classified as significant effects and those as minor or negligible as not significant.

Table 10-5: Significance Criteria

Significance Level		Criteria	CIEEM Geographical Criteria
Significant	Major	These effects are likely to be important considerations at a local or regional scale but, if adverse, are potential concerns to the project and may become key factors in the decision-making process.	Ecological impacts assessed as being significant at the regional scale and that have triggered a response in development control terms are considered to represent impacts that overall, within this assessment, are of major significance.
	Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.	Ecological impacts assessed as being significant at the county/metropolitan scale, and that have triggered a response in development control terms, are considered to represent impacts that overall, within this assessment, are of moderate significance.
Not significant	Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.	Ecological impacts assessed as being significant at the local scale, and that have triggered a response in development control terms, are considered to represent impacts that overall, within this assessment, are of minor significance.
	Insignificant	No effect or an effect which is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error.	Ecological impacts that have been assessed as not being significant at any geographic level.

Impact assessment guidance tables

10.4.23 The matrices in **Table 10-6** to **Table 10-8** have been used to help assess significance.

10.4.24 **Table 10-6** has been used as a means of generating an estimate of exposure to *change. Once a magnitude has been assessed, this has been combined with the* probability of occurrence to arrive at an exposure score which can then be used for the next step of the assessment, which is detailed in **Table 10-7**. For example, an impact pathway with a medium magnitude of change and a high probability of occurrence would result in a medium exposure to change.

Table 10-6: Exposure to change, combining magnitude and probability of change

Probability of Occurrence	Magnitude of Change			
	Large	**Medium**	**Small**	**Negligible**
High	High	Medium	Low	Negligible
Medium	Medium	Medium/Low	Low /Negligible	Negligible
Low	Low	Low /Negligible	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

10.4.25 **Table 10-7** has then been used to score the vulnerability of the features/receptors of interest based on the sensitivity of those features and their exposure to a given change.

Table 10-7: Estimation of vulnerability based on sensitivity and exposure to change

Sensitivity of Receptor (Table 10-2)	Exposure to change (Table 10-6)			
	High	**Medium**	**Low**	**Negligible**
High	High	High	Moderate	None
Moderate	High	Moderate	Low	None
Low	Moderate	Low	Low	None
None	None	None	None	None

10.4.26 The vulnerability has then been combined with the importance of the feature of interest using **Table 10-8** to generate an initial level of significance. For example, if a high vulnerability is assessed against a feature of low importance, the level of significance of the effect is assessed as minor.

Table 10-8: Estimation of significance based on vulnerability and importance

Importance of Receptor (Table 10-4)	Vulnerability of Feature to Impact (Table 10-7)			
	High	**Moderate**	**Low**	**None**
High	Major	Moderate	Minor	Insignificant
Moderate	Moderate	Moderate/Minor	Minor/Insignificant	Insignificant
Low	Minor	Minor/Insignificant	Insignificant	Insignificant
None	Insignificant	Insignificant	Insignificant	Insignificant

Significance criteria impact management (mitigation)

10.4.27 Impacts that are found to be significant in the process, (i.e., moderate and/or major adverse) may require mitigation measures to reduce residual impacts, as far as possible, to environmentally acceptable levels. Within the assessment procedure the use of mitigation measures will alter the risk of exposure and, hence, will require significance to be re-assessed and thus the residual impact (i.e., with mitigation) identified.

10.4.28 Mitigation measures considered throughout the EIA process can take three forms (as summarised in **Chapter 5: EIA Approach [TR030008/APP/6.2]**) (Ref 10-85):

a. *Embedded mitigation measures:* modifications to the location, design or operation of a development that are an inherent part of the Project and do not require additional action to be taken.

b. *Standard mitigation measures:* measures comprising management activities and techniques, which would be implemented during construction of the Project to limit impacts through adherence to good site practice and achieving legal compliance. These measures for the construction phase are set out in the **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.5]**.

c. *Additional mitigation measures:* these comprise measures over and above any embedded and standard mitigation measures, for which the EIA has identified a requirement to further reduce likely significant environmental effects.

10.4.29 In addition, it is appropriate to adopt a mitigation hierarchy which, from the CIEEM (Ref 10-3) guidance on ecological impact assessment specifically, can be summarised as follows:

a. In the first instance, seek to adopt options that avoid harm.

b. Identify ways to minimise adverse effects that cannot be completely avoided through mitigation.

c. Provide compensation where there are significant residual adverse effects despite the mitigation proposed.

d. Provide net benefits (for biodiversity) above requirements for avoidance, mitigation or compensation.

10.4.30 In some instances, a decision may need to be taken despite residual uncertainty about the effects. In such cases, adaptive management, linked to a bespoke monitoring programme, is a well-established and recommended way of ensuring that any negative impacts or effects are addressed in the course of the development and during the subsequent operational phase.

Limitations and Assumptions

10.4.31 This assessment has been undertaken based on the following assumptions:

a. The Project design, as defined by the Parameters and the indicative construction methodology are provided in **Chapter 2: The Project [TR030008/APP/6.2]**.

b. Future maintenance dredging within the new berth pocket is expected to be very limited (if required at all) as summarised in the physical processes assessment (**Chapter 16: Physical Processes** of the **ES [TR030008/APP/6.2]**).

10.4.32 Whilst these are assumptions, the assessment within this ES has been undertaken considering the anticipated worst-case scenario in respect of ornithology receptors at the dredge, marine piling and disposal locations.

10.5 Study Area

10.5.1 The study area is the area over which potential direct and indirect effects of the Project may occur during construction and operation. The direct effects on ornithology receptors are those that occur within the footprint of the Project, such as the direct disturbance to supporting habitats and associated species as a result of the Project. Indirect effects are those that may arise outside this footprint, such as the potential noise and visual disturbance effects on waterbirds during construction.

10.5.2 The study area for coastal waterbirds is focused on the Port of Immingham ("the Port") area and proposed dredge disposal sites, with data for the wider Humber Estuary region presented where relevant to provide contextual information and to ensure the area of potential effects (e.g. noise disturbance) are fully considered. The study area for coastal waterbirds includes any terrestrial habitats adjacent to/ in close proximity to the Estuary that may support these species over the high tide period when intertidal habitats are reduced.

10.5.3 The study area for breeding birds (non-SPA/Ramsar species) comprised terrestrial habitats within the red line boundary that were identified as having the potential to support nesting species. The rationale for the scoping of breeding bird surveys is set out in the **Preliminary Ecological Appraisal** ("PEA") (**Appendix 8.B [TR030008/APP/6.4]**).

10.6 Baseline Conditions

Current Baseline

10.6.1 Current baseline conditions have been determined by a desk-based review of available information (as well as the field surveys undertaken as set out in **Section 10.6**) including:

a. Immingham Outer Harbour ("IOH") Ornithology Surveys: Data from surveys carried out for a separate development (the IOH) have been used to inform the baseline for this Project as the IOH survey boundary overlaps with the Project area (**Figure 10.1 [TR030008/APP/6.3]**). The coastal waterbird surveys started in winter 1997/98 and have been ongoing annually since then with winter surveys undertaken between October and March twice a month. During each survey, either four counts (November to February) or five counts (other months) are undertaken every two hours after high water. The most recent five-years of data (2018/19 to 2022/23) has been analysed. In addition, the 2021/22 survey season started in August rather than October. The surveys have been continued on a monthly basis throughout 2022 rather than stopping in March as per previous years. On this basis, the results from surveys covering passage and summer months (August and September 2021 and April to September 2022) have also been presented.

b. WeBS Core Counts Data: Core count data for 'Immingham Docks - Sector K' (ID 38905) which overlaps with the Project. These surveys are typically undertaken around high water. The most recent 5-years of data available from the British Trust for Ornithology ("BTO") (2017/18 to 2021/22) has been analysed. In addition, estuary wide WeBS data for the Humber Estuary for 2017/18 to 2021/22 has also been reviewed to provide contextual information (Ref 10-20).

c. NE Designated Sites Portal: Background information on the ecology of SPA qualifying bird species in the Humber Estuary (Ref 10-21).

d. Population Trends for Species in the Humber Estuary: Information on long-term trends in the population status of waterbirds in the Humber Estuary is available for the period up to 2016/2017 from the latest WeBS 'Alerts Report' (Ref 10-22). This is an information source describing waterbird numbers on protected areas and has an 'alert system' where species that have undergone major declines in numbers are identified.

e. BTO Research Report Analysing WeBS data for the Humber Estuary: Population trends of waterbird species in different parts of the Humber Estuary for the period 2000/01 to 2016/17 (Ref 10-23).

f. Wintering/passage surveys of land within West Site and the Temporary Compound Area in winter 2022/23 that were identified during the Phase 1 Habitat survey as being potentially suitable for wintering/ passage waterbirds, to determine whether the land supported important aggregations of Humber Estuary SPA/Ramsar waterbirds such that it would be considered 'functionally linked land'.

Breeding bird surveys of land within West Site (in spring/ summer 2022), East Site – Ammonia storage area (in spring/summer 2023) and Long Strip Woodland (in spring/summer 2023) that were identified during the Phase 1 Habitat survey as being potentially suitable for notable aggregations of breeding birds.

Nature conservation sites and protected species

Designated sites

10.6.2 The Project falls within the boundaries of the Humber Estuary SAC, SPA and Ramsar site (collectively forming the Humber European Marine Site ("EMS"); **Figure 10.2 [TR030008/APP/6.3]**).

10.6.3 Qualifying features of the Humber Estuary SPA and Humber Estuary Ramsar site are shown in **Table 10-9** and **Table 10-10** respectively, at the time of designation in 2005.

Table 10-9: Qualifying features of the Humber Estuary SPA

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Bittern *Botaurus stellaris*	Two calling males (10.5 % of the GB population)
Marsh Harrier *Circus aeruginosus*	Ten breeding females (6.3 % of the GB population)
Avocet *Recurvirostra avosetta*	64 pairs (8.6 % of the GB population)
Little Tern *Sternula albifrons*	51 pairs (2.1 % of the GB population)
Wintering Species Population	
Bittern	Four (4.0 % of the GB population)
Hen harrier *Circus cyaneus*	Eight (1.1 % of the GB population)
Bar-tailed Godwit *Limosa lapponica*	2,752 (4.4 % of the GB population)
Golden Plover *Pluvialis apricaria*	30,709 (12.3 % of the GB population)
Avocet *Recurvirostra avosetta*	54 (1.7 % of the GB population)
On passage Species population	
Ruff *Calidris pugnax*	128 (1.4 % of the GB population)

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Migratory Species	
Wintering Species Population	
Teal† *Anas crecca*	2,322 (<1 % of the population)
Wigeon† *Mareca penelope*	5,044 (<1 % of the population)
Mallard† *Anas platyrhynchos*	2,456 (<1 % of the population)
Turnstone† *Arenaria interpres*	629 (<1 % of the population)
Common Pochard† *Aythya ferina*	719 (<1 % of the population)
Greater Scaup† *Aythya marila*	127 (<1 % of the population)
Brent Goose† *Branta bernicla*	2,098 (<1 % of the population)
Goldeneye† *Bucephala clangula*	467 (<1 % of the population)
Sanderling† *Calidris alba*	486 (<1 % of the population)
Dunlin *Calidris alpina*	22,222 (1.7 % of the Northern Siberia/Europe/Western Africa population)
Red Knot *Calidris canutus*	28,165 (6.3 % of the North-eastern Canada/Greenland/Iceland/North-western Europe population)
Ringed Plover† *Charadrius hiaticula*	403 (<1 % of the population)
Oystercatcher† *Haematopus ostralegus*	3503 (<1 % of the population)
Black-tailed Godwit *Limosa*	1,113 (3.2 % of the Icelandic Breeding population)
Curlew† *Numenius arquata*	3,253 (<1 % of the population)
Grey Plover† *Pluvialis squatarola*	1,704 (<1 % of the population)
Shelduck *Tadorna tadorna*	4,464 (1.5 % of the North-western Europe population)
Redshank *Tringa totanus*	4,632 (3.6 % of the Eastern Atlantic Wintering population)
Northern Lapwing† *Vanellus vanellus*	22,765 (<1 % of population)
On passage Species Population	
Sanderling†	818 (<1 % of the population)

Internationally Important Populations	
Dunlin	20,269 (1.5 % of the Northern Siberia/Europe/Western Africa population)
Red Knot	18,500 (4.1 % of the North-eastern Canada/Greenland/Iceland/North-western Europe population)
Ringed Plover†	1,766 (<1 % of the population)
Black-tailed Godwit	915 (2.6 % of the Icelandic Breeding population)
Whimbrel† *Numenius phaeopus*	113 (<1 % of the population
Grey Plover†	1,590 (<1 % of the population)
Greenshank† *Tringa nebularia*	77 (<1 % of the population)
Redshank	7,462 (5.7 % of the Eastern Atlantic Wintering population)
Internationally Important Assemblage of Waterfowl	
Waterfowl assemblage	153,934 waterfowl
†Species with this symbol do not represent a population that is > 1 % of the international threshold but are included in the waterfowl assemblage.	

Source: Ref 10-25

Table 10-10: Qualifying marine features of the Humber Estuary Ramsar Site

Ramsar Criterion	
Criterion 1 – natural wetland habitats that are of international importance	
The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.	
Criterion 3 – supports populations of plants and/or animal species of international importance	
The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast.	
Criterion 5 – Bird Assemblages of International Importance	
Wintering waterfowl	153,934 waterfowl (five-year peak mean 1998/99-2002/23)

Ramsar Criterion	
Criterion 6 – Bird Species/Populations Occurring at Levels of International Importance	
Species	Spring/Autumn Population (5-year peak mean 1996-2000)
Golden Plover	17,996 (2.2 % of the Iceland & Faroes/East Atlantic population)
Red Knot	18,500 (4.1 % of the West & Southern African wintering population)
Dunlin	20,269 (1.5 % of the West Siberia/West Europe population)
Black-tailed Godwit	915 (2.6 % of the Iceland/West Europe population)
Redshank	7,462 (5.7 % of the population)
Species	Wintering Population (5-year peak mean 1996/97-2000/01)
Shelduck	4,464 (1.5 % of the North-western Europe Population)
Golden Plover	30,709 (3.8 % of the Iceland & Faroes/East Atlantic population)
Red Knot	28,165 (4.1 % of the West & Southern African wintering population)
Dunlin	22,222 (1.7 % of the West Siberia/West Europe population)
Black-tailed Godwit	1,113 (3.2 % of the Iceland/West Europe population)
Bar-tailed Godwit	2,752 (2.3 % of the West Paleartic population)
Criterion 8 – Internationally important source of food for fishes, spawning grounds, nursery and/or migration path	
The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.	

Source: Ref 10-26

10.6.4 The Greater Wash SPA is designated for a range of seabird and diving bird species and is located approximately 20km from the Study Area but has been included given the potential for connectivity between this SPA and the Study Area. Qualifying features of this site are shown in **Table 10-11**.

Table 10-11: Qualifying marine features of the Greater Wash SPA

Internationally Important Populations	
Internationally Important Populations of Regularly Occurring Annex 1 Species	
Breeding Species Population	
Little Tern *Sternula albifrons*	798 pairs (42 % of GB breeding population)
Common Tern *Sterna hirundo*	510 pairs (5.1% of GB breeding population)

Internationally Important Populations	
Sandwich Tern *Sterna sandvicensis*	852 pairs (35% of GB breeding population)
Wintering Species Population	
Little Gull *Hydrocoloeus minutus*	1,255 (no current GB population estimate)
Red-throated Diver *Gavia stellata*	1,407 (8.3% of GB non-breeding population)
Internationally Important Populations of Regularly Occurring Migratory Species	
Common Scoter *Melanitta nigra*	3,449 (0.6% of biogeographic population)

Source: Ref 10-27

10.6.5 The Humber Estuary SSSI overlaps part of Study Area. This is designated for its nationally important habitat assemblage (intertidal mudflats and sandflats, and coastal saltmarsh) geological interest, importance to breeding, wintering and passage birds, breeding grey seal and the presence of river and sea lamprey.

10.6.6 North Killingholme Haven Pits SSSI is located approximately 6km away from the Study Area. This SSSI comprises saline lagoon habitats and supports important populations of waders including Black-tailed Godwits and Redshank. The Lagoons SSSI is located approximately 20km from the Site and supports a variety of coastal habitats (such as saline lagoons and sand dunes) and well as a population of breeding Little Terns.

10.6.7 The nearest Local Nature Reserve ("LNR") is Cleethorpes Sands LNR (located approximately 13km south east of the Study Area) which supports a variety of intertidal and coastal habitats.

Protected species

10.6.8 The *Wildlife and Countryside Act (1981) (as amended)* (Ref 10-13) protects various animals, plants, habitats in the UK including bird species. In addition, all naturally occurring wild bird species, their eggs, nests and habitats are strictly protected under the Birds Directive.

10.6.9 Some marine fauna and habitats are listed as priority species and habitats of principle importance in England, as required under Section 41 of the *NERC Act (2006) (England)* (Ref 10-15). Species of principle importance which are of relevance to the Humber Estuary include various species of waterbird. Habitats of principle importance of relevance to the Humber Estuary include supporting habitat for waterbirds including intertidal mudflats and coastal saltmarsh.

Coastal waterbirds

Humber Estuary overview

10.6.10 The Humber Estuary is a site of national and international importance for its waders and wildfowl (ducks and geese) populations, regularly supporting over 130,000 waterbirds during winter and passage periods (Ref 10-20; Ref 10-23).

10.6.11 Waterbird numbers are highly variable in the Humber Estuary throughout the year, but it is considered to be an important site year-round due to the presence of different populations of wintering, passage and breeding birds which move into and out of the estuary. In general, numbers of coastal waterbirds are at their lowest during June, when the assemblage is dominated by wildfowl, before numbers start increasing during July due to the return of waders such as Dunlin. Golden Plover starts to become more abundant in late summer. The arrival of wintering waterfowl such as Pink-footed Geese and Wigeon as well as wader species such as Knot typically occurs in early autumn. Numbers start to fall in late winter with the departure of species such as Golden Plover and Knot, before increasing slightly in spring as passage flocks start to move through the area and wildfowl depart (Ref 10-21).

10.6.12 **Table 10-12** provides summary ecology information on key waterbird species occurring in the Humber Estuary in intertidal and marine habitats. This includes the five-year estuary-wide mean peaks for these species for 2017/18 to 2021/22 (the most recent five-years of data available from the BTO) (Ref 10-20).

Table 10-12: Summary information for key species of coastal waterbird in the Humber Estuary

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
Wader	Golden Plover	Roosts but rarely feeds in the intertidal	Mainly insects, especially beetles, as well as other invertebrates and some plant material.	Golden Plover mainly uses the estuary to roost in areas including Alkborough Flats, Whitton Sands, Blacktoft Sands, Read's Island in the Inner Humber Estuary and Salt End, Stone Creek, Paull Holme Stray, Cherry Cobb Sands and Pyewipe in the Middle Humber.	Oct-Dec	20,812
	Knot	Intertidal benthivore	Mainly molluscs, including the bivalve *Limecola balthica*, cockles *Cerastoderma edulis* and mud snail *Peringia ulvae*, the latter especially in early winter. Diet proportions of 75% bivalves, 1% worms and 24% 'other'. Prey is eaten whole and crushed within the gizzard.	Knot is found in the outer Humber including Cherry Cobb Sands and the Lincolnshire coast south of Grimsby. Easington Lagoons provide an important roost site for Knot during high spring tides.	Jan, Oct-Dec	26,428
	Lapwing	Roosts but rarely feeds in the intertidal	Wide range of invertebrates including beetles and earthworms.	Lapwing mainly uses the estuary to roost in areas including Alkborough Flats, Whitton Sands, Blacktoft Sands and Read's Island	Jan-Feb, Nov-Dec	15,247

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
				in the Inner Humber Estuary as well as Salt End, Stone Creek, Paull Holme Stray, Cherry Cobb Sands and Pyewipe (all Middle Humber Estuary). The majority of feeding occurs inland, though some feeding on intertidal areas takes place during July to September.		
	Dunlin	Intertidal benthivore	Oligochaetes, polychaete worms (such as *Hediste diversicolor, Nephtys* spp., *Pygospio elegans* and *Scoloplos armiger*), bivalves (such as *Limecola balthica*) and the mud snail *Peringia ulvae*. Diet proportions of 70% worms, 14% bivalves and 16% 'other'.	Widespread with important areas including Read's Island (Inner Humber Estuary), Cherry Cobb Sands, Pyewipe, Stone Creek and Salt End (all Middle Humber Estuary) and Saltfleet (Outer Humber Estuary).	Aug, Nov.	17,634
	Oystercatcher		Predominantly bivalves especially large cockles *Cerastoderma edule*, mussels *Mytilus edulis* and tellins *Limecola* spp. Diet might also include	Found predominantly in the Outer Humber Estuary. The most important areas for Oystercatcher are along the Lincolnshire coast.	Feb, Aug-Nov	5,806

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
			polychaete worms on mudflats and earthworms from wet fields.			
	Black-tailed Godwit		Invertebrates, including beetles, polychaete worms (such as *Hediste diversicolor, Nephtys, Pygospio elegans* and *Scoloplos armiger*), molluscs (such as *Limecola balthica)* crustaceans and some plant material.	Key areas include Pyewipe and North Killingholme Haven Pits for this species during winter.	Aug-Oct	5,646
	Grey Plover		Polychaete worms (such as *Hediste diversicolor* and *Arenicola marina*), bivalves (such as *Limecola balthica*) and the muds snail *Peringia ulvae.*	Widespread usage across the Middle and Outer parts of the Humber Estuary. Typically, more usage of the north bank compared to the south bank. Particular key areas include Cherry Cob Sands, and Welwick.	Jan, Sep-Oct	2,985
	Redshank		Polychaete worms (such as *Hediste diversicolor, Nephtys spp., Pygospio elegans and Scoloplos armiger*), the bivalve	Widespread with key areas including Cherry Cobb Sands and in the outer Humber Estuary.	Sep, Nov-Dec	2,659

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
			Limecola balthica, crustaceans (such as brown shrimp *Crangon crangon and* mud shrimp *Corophium* spp.*) and* the mud snail *Peringia ulvae*. Will also consume terrestrial invertebrates, including insects and spiders. Diet proportions of 46% worms, 7% bivalves and 47% 'other'.			
	Curlew		Primarily bivalves (such as *Cerastoderma edule* and *Limecola balthica)*, the ragworm *Hediste diversicolo*r and lugworm *Arenicola marina).* Earthworms on terrestrial habitats, Diet proportions during winter of 46% bivalves, 35% worms and 19% 'other'.	Important areas include Cherry Cobb sands and Patrington to Easington (Outer North), Read's Island (Inner Humber), Pyewipe, Salt End (both Middle Humber) and Theddlethorpe St. Helen (Outer South).	Jan, Oct, Dec	2,544
	Avocet		Benthic crustaceans e.g. *Corophium* spp. and worms such as ragworm	Largest wintering flocks are present in the inner Humber around Far Ings/Read's Islands,	Aug-Sep	2,576

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
			*H. diversicolo*r. Insects, especially Chironomidae larvae, in freshwater habitats.	close to the favoured locations for breeding.		
	Bar-tailed Godwit		Polychaete worms are the principal food source during winter such as *Hediste diversicolor, Nephtys, Pygospio elegans and Scoloplos armiger*. Diet proportions comprise 94% worms. Other species sometimes consumed include the shrimp *Crangon crangon* and bivalve *Limecola balthica.*	The most important sectors for Bar-tailed Godwit are the three sectors that make up the Outer (North) area, and the adjacent Cherry Cobb Sands (Middle Humber), and Paull Holme Strays (also Middle Humber).	Feb, Sep, Nov-Dec	1,867
	Ringed Plover		In winter, mainly marine worms, crustaceans (such as *Corophium* spp.) and molluscs (such as *Peringia ulvae*).	Most commonly recorded in the Outer Estuary.	Aug-Sep	1,070
	Sanderling		Polychaete worms (such as *Hediste diversicolor*), crustaceans and insects.	Within the Humber Estuary, Sanderling are found exclusively in the outer estuary, particularly on	Feb, May, Aug, Nov-Dec	575

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
			Diet proportions comprise 60% worms, 1% molluscs and 39% 'other'.	the sandflats of the Lincolnshire coast.		
	Turnstone		A wide range of invertebrates and other food sources. This includes polychaete worms and mudshrimp *Corophium* spp. on mudflats. Also feeds on rocky shore species, including mussels, amphipods, molluscs (such as periwinkles) and crabs. Diet proportions comprise 20% bivalves, 5% worms and 75% 'other'.	Key areas for Turnstone include rocks around New Holland between Barton upon Humber and East Halton (Middle Humber) and between Grimsby and Cleethorpes (Outer South). Also feed on jetties and around the harbours.	Feb, Oct-Dec	287
	Whimbrel		On passage the species consumes shrimps, molluscs, worm and crabs.	No obvious preferred areas, found throughout the Humber during migration periods.	Jul-Aug	58
	Ruff	Intertidal benthivore on mudflats but	Omnivore feeding on insects, larvae, frogs, small fish and seeds.	The Humber Estuary is considered an important site for passage Ruff. The most important areas of the Humber for the ruff are the	Aug-Oct	76

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
		omnivores more generally		intertidal mud and sand flats and adjacent lagoons of Alkborough Flats and Blacktoft Sands with smaller numbers also observed wintering along the River Trent, at North Killingholme and at Tetney). During autumn, Paull Holme Strays, Sunk Island, Read's Island, New Holland and Whitgift Sand on the River Ouse are also important areas.		
Water-fowl	Pink-footed Goose	Herbivorous waterfowl	Herbivorous. Outside the breeding season this species feeds on improved grasslands, cereal stubbles and vegetables (e.g. potatoes, sugar beet, carrots).	Recorded mainly on Read's Island, which it uses as a roosting site, flying inland during the day to feed in fields.	Oct-Nov	25,332
	Shelduck	Intertidal benthivore	Invertebrates, with small molluscs predominant in north and west Europe, especially mud snail *Peringia* spp. Other species consumed include the mud shrimp	Shelduck are found throughout the estuary with key areas including Read's Island and Alkborough Flats (Inner Humber) and at Pyewipe, Salt End, Cherry Cobb Sands and Paull Holme Sands (Middle Humber).	Jul, Oct-Nov	6,486

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
			Corophium volutator, bivalves and polychaetes.			
	Teal	Omnivorous waterfowl	Seeds of saltmarsh and other wetland plants, including glasswort Salicornia spp. and oraches *Atriplex* spp., and invertebrates (especially small oligochaetes) sifted from the benthos.	Key areas include Alkborough Flats, Read's Island and Blacktoft Sands.	Oct-Nov	5,286
	Dark-bellied Brent Goose	Herbivorous waterfowl	Mainly grasses, and on arable land the shoots of winter cereals, and oilseed rape. On estuaries, eelgrass *Zostera* spp. and saltmarsh plants.	The North Lincolnshire coast between Tetney and Donna Nook is a key area. Spurn is also important during spring passage.	Jan, Nov-Dec	2,645
	Wigeon		Plants (leaves, stems, stolons, bulbils and rhizomes).	Alkborough Flats and Read's Island as well as Faxfleet to Brough Haven (also Inner Humber) are key areas.	Jan-Feb, Oct-Nov	3,669
	Greylag Goose		Grass, roots, cereal leaves and spilled grain.	Present within the Inner Humber to a greater extent (e.g. Faxfleet). Present in greatest numbers close to freshwater pools.	Aug-Nov	1,796

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
	Mallard	Omnivorous waterfowl	Omnivorous, including both plants and animal matter.	Occurs throughout Humber Estuary, with key areas including the River Ouse and Cherry Cobb Sands. The area around the outfall at New Holland is also a favoured area where the birds feed on grain spill from the dock.	Jan, Aug-Sep, Nov	1,109
	Barnacle Goose	Herbivorous waterfowl	The leaves and stems of grasses, roots and seeds.	Present on fields/arable land around the entire Humber Estuary in low densities.	Jan-Mar, Sep, Dec	755
	Common Scoter	Benthivorous diving duck	Molluscs.	Present within the Outer Humber due to their more pelagic lifestyle. Occurs in passage and winter.	Mar, Sep-Oct, Dec	408
	Canada Goose	Herbivorous waterfowl	Roots, grass, leaves and seeds.	Occurs within the Inner Humber in the largest numbers. Present in greatest numbers close to freshwater pools.	Aug-Sep	691
	Goldeneye	Benthivorous diving duck	Mostly aquatic insects, molluscs and crustaceans. Occasional fish. Plant material generally less than 25%.	Goxhill to New Holland and Barrow to Barton (including Barton Pits) are key areas.	Nov-Dec	299

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
Gull	Black-headed Gull	Omnivorous/ scavenging gull	Worms, insects, small fish, crustacea and carrion.	Widely distributed.	Aug-Oct	13,018
	Common Gull		Worms, insects, fish and carrion.	Widely distributed.	Feb, Sep-Oct, Dec	1,293
	Herring Gull		Carrion, offal, seeds, fruits, young birds, eggs, crustaceans, small mammals, insects and fish.	Widely distributed.	Feb, Apr, July, Sep, Dec	1,334
	Great Black-backed Gull		Shellfish, birds and carrion.	Widely distributed.	Feb, Nov-Dec	213
Terns, and other diving birds	Sandwich Tern	Piscivorous plunge diver	Fish such as sandeels, sprats and whiting.	Widely distributed.	Jul-Aug	578
	Common Tern		Fish and crustaceans in some areas.	Widely distributed.	Aug-Sep	247
	Cormorant	Piscivorous pursuit diver	Feeds on fish such as flatfish, blennies gadoids, sandeel, salmonid and eels.	Widely distributed.	Jan-Mar, Nov	438

Species group	Species	Feeding behaviour in the marine environment [1]	Diet [2]	Distribution in the Humber Estuary [3]	Month of peak count [4]	WeBS Core Count 5-year estuary-wide mean peaks (2017/18 to 2021/22) [5]
	Red-throated Diver	Piscivorous pursuit diver	Diet consists predominantly of fish (mainly clupeids, mackerels, flatfish, gadoids and sand eels).	Recorded mainly in the outer Humber Estuary and approaches.	Jan, Oct, Dec	33

1. Feeding behaviour based on Ref 10-28 and Ref 10-29:

Intertidal benthivore: Waterbird species feeding on infaunal and/or epibenthic invertebrates in intertidal habitats.

Herbivorous waterfowl: Geese, swans and ducks feeding on plant material.

Omnivorous waterfowl: Ducks feeding on a range of animal and plant food.

Benthivorous diving duck: Diving ducks/seaducks feeding on epibenthic and infaunal invertebrates on the seabed.

Omnivorous/scavenging gull: Gulls feeding on a range of animal and plant food including through scavenging.

Piscivorous plunge diver: Seabirds foraging for fish through plunge diving.

Piscivorous pursuit diver: Seabirds foraging for fish through pursuit diving.

2. Based on Ref 10-30; Ref 10-31 and Ref 10-32.

3. Based on Ref 10-31 and Ref 10-33

4. Months when peaks count occurred in the 2017/18 to 2021/22 estuary-wide BTO Core Counts (Ref 10-20).

5.Data from Ref 10-20.

10.6.13 The most abundant wading bird species recorded in the Humber Estuary are Knot and Golden Plover (five-year mean peak for 2017/18 to 2021/22 of 26,428 and 20,812 birds respectively). Other wading birds occurring in large numbers include Lapwing (five-year mean peak of 15,247 birds) and Dunlin (five-year mean peak of 17,634 birds) as well as Oystercatcher, Black-tailed Godwit, Grey Plover, Curlew, Avocet and Bar-tailed Godwit (Ref 10-20). Important areas for feeding and roosting waders include the Pyewipe frontage on the south bank and Paull Holme, Cherry Cobb, Foulholme, Spurn and Sunk Island Sands on the north bank of the Humber Estuary. In the inner section of the Humber Estuary, sites such as Blacktoft Sands, Alkborough and Read's Island Flats are considered important (Ref 10-21). The numbers of different waders in the Humber Estuary can show a high degree of interannual variation with some species (such as Black-tailed Godwit, Avocet, Oystercatcher) showing an overall long-term increase in estuary wide numbers with other species such as Dunlin, Redshank and Knot showing an overall decline (Ref 10-31; Ref 10-22).

10.6.14 Key prey items for waders on the Humber Estuary include annelid worms (such as *ragworm Hediste diversicolor, lugworm Arenicola marina, Pygospio elegans, Streblospio shrubsolii, Tubificoides spp., and Nephtys spp), the bivalves Cerastoderma edule and Limecola balthica, the mudsnail Peringia spp. and mud shrimp Corophium spp* (Ref 10-30; Ref 10-31).

10.6.15 The most abundant wildfowl bird species recorded in the Humber Estuary are Pink-footed Goose and Shelduck (five-year mean peak of 25,332 and 6,486 birds respectively). The number of Shelduck in the Humber Estuary has remained relatively stable with Pink-footed Goose showing a long-term increase (Ref 10-23; Ref 10-22). Other commonly occurring wildfowl include Teal, Dark-bellied Brent Geese, Wigeon, Greylag Goose and Mallard (Ref 10-20). Pink-footed Goose are recorded in large numbers at Read's Island with Dark-bellied Brent Geese and Wigeon, principally occur in areas along the southern shore from Cleethorpes to Saltfleetby (Ref 10-21).

10.6.16 Black-headed Gull (five-year mean peak of 13,018 birds) as well as Herring Gull and Common Gull (occurring in lower numbers) are widespread in the Humber Estuary.

10.6.17 The Humber Estuary also supports several heron species including Grey Heron, Little Egret and Great Bittern. Grey Heron and Little Egret are recorded in a wide variety of intertidal and coastal habitats with Great Bittern recorded within reedbed habitats such as around Blacktoft Sands, Far Ings, Barton and North Killingholme Haven clay pits (Ref 10-21).

10.6.18 Diving birds occurring in the Humber Estuary include Common Scoter and Goldeneye (five-year mean peak of 408 and 299 birds respectively) with Cormorants and Tufted Duck also occurring in relatively large numbers.

10.6.19 Little Tern breed at Easington Lagoon, which is located approximately 20km from the Project (Ref 10-21), with data suggesting this species forages within 5km of nesting sites (Ref 10-34. Sandwich Tern (five-year mean peak of 578 birds) and Common Tern (five-year mean peak of 247 birds) are also regularly recorded, particularly in passage periods in the Humber Estuary.

Immingham area

10.6.20 Pre and post consent monitoring of coastal waterbird surveys as part of the IOH development have been undertaken annually since winter 1997/98. The foreshore in the area of the Project overlaps with 'Sector C' (between the Immingham Oil Terminal ("IOT") Jetty and Oldfleet Drain (as shown in **Figure 10.1 [TR030008/APP/6.3]**). The most recent five-years of data (2018/19 to 2022/23) has been analysed for this sector (**Table 10-13**). During this period, surveys were undertaken between October and March twice a month. During each survey, either five counts (October and March) or four counts (November to February) were undertaken every two hours after high water. In addition, the 2021/22 survey season started early in August rather than October. The surveys have continued on a monthly basis in 2022 rather than stopping in March as per previous years. On this basis, the results from passage and summer months (August and September 2021 and April to September 2022) have been presented separately (**Table 10-14**). **Appendix 10.A [TR030008/APP/6.4]** presents monthly peak counts for the period October 2021 to September 2022.

10.6.21 To summarise the findings from the survey work, the annual peak count (maximum count from each winter period between October and March) for birds feeding, roosting as well as the combined total[4] is presented in **Table 10-13**. The five-year average of the annual peak counts for each species (referred to as the mean peak)[5] is also presented in **Table 10-13**. This table also compares the five-year mean peak against the thresholds and values outlined below, to provide objective criteria to help determine the value of the area in an international, national and regional context:

a. **Internationally Important Threshold Level**: The threshold for an individual species (or subspecies) is set at 1% of the biogeographic population[6].

b. **Nationally Important Threshold Level:** The threshold for an individual species (or subspecies) is set at 1% of the British population i.e. if a site supports more than 1% of the British population it is considered Nationally Important (for that species or subspecies).

4 The combined peak count is a summed value derived from the largest count of both feeding and roosting birds during the same hourly count.

5 It is standard practice to present the average of the annual peaks for a certain duration of time (sometimes referred to as the mean of peaks). This is calculated as the average of the maximum annual counts and for the most recent ive-years of available data if possible. Mean peaks (using five-years of winter values) is the approach presented in the WeBS annual reports. For most migratory species, the WeBS five-year mean of peak is also the value that is used when identifying qualifying features for each SPA. Using mean of peaks is also useful for characterising the relative importance of sectors within a site, as it gives a good indication of how many individuals of a given species a sector typically supports (Ref 10-35).

6 The thresholds levels are available at: https://www.bto.org/volunteer-surveys/webs/data/species-threshold-levels. It should be noted that, where 1% of the population is less than 50 birds, 50 is normally used as a minimum qualifying threshold for the designation of sites of national or international importance (accessed 04/04/22) (Ref 10-36).

c. **Latest Humber Estuary WeBS Core Counts ive-year average:** The five-year mean peak from the latest Humber Estuary WeBS Core Counts. Core Count surveys are typically undertaken around high water. Within this assessment, this is from 2017/18 to 2021/22 (Ref 10-20). For the purposes of this assessment, numbers representing more than 10 % of the estuary-wide Core Counts for an individual species are considered regionally important and numbers representing between 1% and 10% are considered locally important [7].

10.6.22 The five-year mean peak number of birds in Sector C during different winter months is presented in **Figure 10.3 [TR030008/APP/6.3]** to show any seasonal trends over the winter period. The distribution of birds within Sector C based on distribution data collected in the surveys is shown in **Figure 10.4 [TR030008/APP/6.3]**.

10.6.23 During the surveys, over 25 waterbird species have been recorded on the foreshore within Sector C with approximately 20 species considered regularly occurring.

10.6.24 The most numerous wading bird species recorded foraging within the area over this period were Black-tailed Godwit and Dunlin (five-year mean peaks of 1609 and 579 birds respectively). It should be noted that during winter 2018/19 and 2019/20 Black-tailed Godwit were recorded in nationally important numbers (annual peak counts of 944 and 752 birds respectively) and in internationally important numbers in 2020/21 2021/22 and 2022/23 (2016,2591 and 1740 birds respectively) (**Table 10-13**). Dunlin were regularly recorded in numbers considered locally important (i.e., representing >1% estuary wide numbers[8]) feeding (annual peak counts ranging from 371 to 842 birds). Other wading birds regularly recorded in numbers considered to be locally important included Bar-tailed Godwit, Curlew, Redshank and Turnstone.

10.6.25 Shelduck were the most abundant wildfowl species recorded foraging (five-year mean peak of 128 birds) with this species recorded in numbers considered to be locally important. Lower numbers of other ducks such as Teal and Mallard were also recorded.

10.6.26 With respect to roosting birds, Black-tailed Godwit was the most numerous species recorded (five-year mean peaks of 574 birds) with internationally important numbers recorded in 2019/20 (1352 birds) and nationally important numbers in 20/21 and 22/23 (700 and 580 birds respectively). Other species regularly recorded roosting included Shelduck and Curlew (five-year mean peak of 32 and 26 birds, respectively) as well as Knot, Redshank and Turnstone.

[7] The 1% local threshold has been requested to be used in the baseline data analysis by Natural England as part of previous developments on the Humber Estuary.
[8] Compared against the estuary-wide WeBS 5-year mean peak (2017/18 to 2021/22).

Table 10-13: Coastal waterbird species recorded as part of the IOH Ornithology Surveys within Sector C during the last five winters

Species	Peak count per winter (feeding)						Peak count per winter (roosting)						Peak count per winter (combined – non-behavioural)					
	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP
Avocet		42	2		3	9		64				13		64	2		3	14
Bar-tailed Godwit	30	54	45	141	55	65	2		3		3	2	30	54	45	141	55	65
Black-headed Gull				83	137	44				76	138	43				83	138	44
Black-tailed Godwit	944	752	2016	2591	1740	1609	1	1352	700	238	580	574	944	1352	2016	2591	1740	1729
Common Gull				1	15	3				5	47	10				5	47	10
Common Sandpiper					1	<1											1	<1
Cormorant					1	<1	1				1	<1	1				1	<1
Curlew†	35	24	35	37	46	35	11	14	57	16	32	26	35	24	57	37	46	40
Dunlin	371	571	554	556	842	579	9	110	6	4	27	31	371	571	554	556	842	579
Gadwall		1				<1					2	<1		1			2	<1

Species	Peak count per winter (feeding)						Peak count per winter (roosting)						Peak count per winter (combined – non-behavioural)					
	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP
Golden Plover				13	1	3			4			<1			4	13	1	4
Goldeneye				1		<1										1		<1
Great Black-backed Gull				1	4	1				2	7	2				2	7	2
Grey plover†		11	20	75	12	24			1			<1		11	20	75	12	24
Greylag Goose				2		<1										2		<1
Herring Gull				13	11	5				8	14	4				13	14	5
Knot	191	110	16	39	24	76		210	2			42	191	210	16	39	24	96
Lapwing†								1			1	<1		1			1	<1
Lesser Black-backed Gull				2	1	<1				4		<1				4	1	1
Little Egret		3			2	1								3			2	1
Little Ringed Plover										1		<1				1		<1

Species	Peak count per winter (feeding)						Peak count per winter (roosting)						Peak count per winter (combined – non-behavioural)					
	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP
Mallard†	2	3				1		2	2			<1	2	3	2			1
Mute swan										1	1	<1				1	1	<1
Oystercatcher†	4	9	7	7	5	6	2	2	7	2	4	3	4	9	7	7	5	6
Pink-footed Goose									1			<1			1			<1
Purple Sandpiper					1	<1											1	<1
Red-breasted Merganser					1	<1											1	<1
Redshank	38	50	48	80	64	56	5	12	13	44	3	15	38	50	48	80	64	56
Ringed Plover†	3	12	25	2	6	10	1	7	22	16	16	12	3	12	25	16	16	14
Shelduck	152	125	139	128	96	128	26	64	35	18	15	32	152	125	139	128	96	128
Teal†	8	13	3	3	47	15					3	<1	8	13	3	3	47	15
Turnstone†	15	21	28	35	27	25		15	18	23	11	13	15	21	28	35	27	25

Species	Peak count per winter (feeding)						Peak count per winter (roosting)						Peak count per winter (combined – non-behavioural)					
	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP	18/19	19/20	20/21	21/22	22/23	MP
SPA qualifying species highlighted in bold. † Species with this symbol are included within the SPA waterfowl assemblage.																		
	Cells highlighted green indicate the count is of local importance (>1%) of the current estuary wide WeBS five-year MP.																	
	Cells highlighted orange indicate the count is of regional importance (>10%) of the current estuary wide WeBS five-year MP.																	
	Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance (>10% of the estuary wide WeBS five-year MP – 565 birds) is higher than the national importance threshold (390 birds).																	
	Cells highlighted red indicate the count is of international importance.																	

10.6.27 As shown in **Figure 10.3 [TR030008/APP/6.3]**, during the surveys, the largest numbers of wintering Black-tailed Godwit and Bar-tailed Godwit were typically recorded in October. Shelduck numbers were typically largest from January to early March. The numbers of other wintering species were highly variable with no clear pattern.

10.6.28 The data collected during passage and summer periods (August to September 2021 and April to September 2022) recorded a range of species some of which were recorded in relatively large numbers (**Table 10-14**). The number of birds using Sector C was generally higher in the spring months (April to May) than in autumn passage months (August and September) with peak counts of 400 Dunlin and 581 Black-tailed Godwit recorded in the spring and 222 Dunlin and 160 Black-tailed Godwit in the autumn respectively. The count of 581 Black-tailed Godwit exceeded nationally important thresholds. However, counts of these species along with other species including Redshank and Shelduck were typically lower in the passage and summer months than the winter.

10.6.29 All of the species observed in Sector C are frequently recorded in large numbers during both passage and winter periods in the Humber Estuary more widely with the estuary-wide peak abundances of passage birds typically showing a high degree of both monthly and annual variability. This would be expected given the more transient nature of passage birds with numbers fluctuating on a daily basis as birds arrive and depart from sites in the Humber Estuary (Ref 10-23).

10.6.30 Within Sector C, the largest numbers of waterbirds typically occur on mudflat in the east of the sector towards the Pyewipe mudflats near Grimsby. Within this area approximately 500 to 2000 Black-tailed Godwit, 100s of Dunlin as well as lower numbers (<50) of other species such as Shelduck, Redshank and Knot are regularly recorded (**Figure 10.4 [TR030008/APP/6.3]**). Lower numbers are recorded in the western section of Sector C which is described in more detail in the Section below.

10.6.31 The upper shore sea defences in the area are regularly used through the tide by individuals or small flocks of Turnstone (typically < 20 to 30 birds throughout the sector) year round.

10.6.32 The assemblage recorded in the surveys is broadly similar to that recorded during the WeBS Core Counts for the period 2017/18 to 2021/22 (the most recent five-years of data available from the BTO for the 'Immingham Docks Sector K'). The most commonly recorded species were Dunlin (mean peak of 186 birds), Redshank (mean peak of 100 birds), Black-tailed Godwit (mean peak of 40 birds) Shelduck (mean peak of 45 birds), Turnstone (mean peak of 45) and Curlew (mean peak of 12 birds). It is worth noting that this WeBS sector covers a much larger area than Sector C and so it is not directly comparable in terms of spatial extent [9]. Core counts are also only typically undertaken around high water

[9] The sector includes foreshore adjacent to the Port of Immingham and also extents east of the IOT terminal jetty (Ref 10-37).

periods and so do not provide information through the tide or during low water periods.

Table 10-14: Coastal waterbird species recorded as part of the IOH Ornithology Surveys within Sector C during August to September 2021 and April to September 2022

Species	Peak count per passage/summer month (feeding)								Peak count per passage/summer month (roosting)								Peak count per passage/summer (combined – non-behavioural)							
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Avocet			2	1															2	1				
Bar-tailed Godwit	2	3			248		3	27								5	2	3			248		3	27
Black Headed Gull			9	15	44	219	449	297			2	10	2	181	61	216			9	15	44	219	449	297
Black-tailed Godwit	66	160	581	106			39	108		13						38	66	160	581	106			39	108
Common Gull					20	21	1	4				6		5	34	18				6	20	21	34	18
Common Sandpiper	2					2			2							4	2					2		4
Cormorant		1						1		1	1							1	1					1

Species	Peak count per passage/summer month (feeding)								Peak count per passage/summer month (roosting)								Peak count per passage/summer (combined – non-behavioural)							
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Curlew†	14	16	43	16	4	19	20	23	3	3	6	1	3	3	3	4	14	16	43	16	4	19	20	23
Dunlin	1	222	400				47	131	2	3							2	222	400				47	131
Golden Plover			12																12					
Great Black-backed Gull			8	4		4	2	11					1			4			8	4	1	4	2	11
Grey Plover†								4																4
Herring Gull			13	2	4	7	16	27			21	6	2	8	1	31			21	6	4	8	16	31
Knot		6	4	26	3			24										6	4	26	3			24
Lesser Black-backed Gull			6	1	1	14	4	1			2			4					6	1	1	14	4	1

Species	Peak count per passage/summer month (feeding)								Peak count per passage/summer month (roosting)								Peak count per passage/summer (combined – non-behavioural)							
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Little Egret	2	1		1			1	1		1			1			1	2	1		1	1		1	1
Little Ringed Plover	3																3							
Mallard†	1																1							
Oystercatcher†			5	5	3	3	3	2	2	1	2	2					2	1	5	5	3	3	3	2
Pink-footed Goose								1																1
Redshank	6	7	24			13	9	13		2	1					1	6	7	24			13	9	13
Ringed Plover†		1			2			10						2		7		1			2	2		10
Shelduck	88	90	12	5	2	8	116	26		42	10			3		22	88	90	12	5	2	8	116	26
Teal†																2								2

Species	Peak count per passage/summer month (feeding)								Peak count per passage/summer month (roosting)								Peak count per passage/summer (combined – non-behavioural)							
	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22	Aug 21	Sept 21	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sept 22
Turnstone †	16	41	8				16	31	6	12	5			5		6	16	41	8			5	16	31
Whimbrel	1		4	3		1											1		4	3		1		

SPA qualifying species highlighted in bold. † Species with this symbol are included within the SPA waterfowl assemblage.

	Cells highlighted green indicate the count is of local importance (>1%) of the current estuary-wide WeBS five-year MP.
	Cells highlighted orange indicate the count is of regional importance (>10%) of the current estuary-wide WeBS five-year MP.
	Cells highlighted blue indicate the count is of national importance. It should be noted that for Black-tailed Godwit the regional importance (>10% of the WeBS five-year MP – 565 birds) is higher than the national importance threshold (390 birds). The national importance threshold for Common Sandpiper and Whimbrel is set as 1.

Intertidal bird abundance and distribution in the vicinity of the Project

10.6.33 In order to better understand the abundance and distribution of waterbirds within and near to the Project, distribution mapping data for the section of Sector C foreshore between the IOT Jetty and the mudflat fronting North Beck drain (within approximately 400-500m of the Project) has been analysed in more detail. This data was further complimented with discussions with the ornithological surveyors covering the count sector to ensure the information presented is considered representative of this area.

10.6.34 The distribution of waterbirds in this area is shown in **Figure 10.4 [TR030008/APP/6.3]** with the typical range in abundance of the main species recorded from surveys over the last five-years (2018/19 to 2022/23) presented in **Table 10-15.** The abundance levels of these species have also been compared against the estuary-wide WeBS five-year mean peak (2017/18 to 2021/22). Other species such as Bar-tailed Godwit occur in numbers of a few individuals (<5 birds) and have not been included in the table.

10.6.35 The data shows flocks of up to 100 Black-tailed Godwit and Dunlin as well as lower numbers (<10-20 birds) of other waders (such Curlew, Dunlin, Knot, Oystercatcher, Redshank) have been recorded feeding in the area during the winter months. With respect to ducks, Teal (<20-30 birds) and Shelduck (<10-20 birds) have been recorded in this area during the winter months (**Figure 10.4 [TR030008/APP/6.3]**).

10.6.36 As mentioned above, the upper shore boulders and sea defences in Sector C are regularly used through the tide by individuals or small flocks of Turnstone with flocks recorded in the vicinity of the project (typically <20 to 30 birds feeding and roosting year-round). The sea defences and upper shore in this area are typically only used infrequently as a roost by other waders and wildfowl (<10 birds of each species).

10.6.37 When compared to estuary-wide numbers, wintering Black-tailed Godwit and Turnstone (both feeding and roosting) occurred in locally important numbers with counts representing up to 2% and 10% respectively of the estuary-wide WeBS five-year mean peak (2017/18 to 2021/22). Counts of other species represent <1 of the estuary-wide WeBS five-year mean peak.

10.6.38 Data for surveys during the passage and summer periods (August to September 2021 and April to September 2022) recorded lower numbers of waterbirds in this area compared to the winter. With respect to Black-tailed Godwit <10 feeding birds were recorded during some of the autumn surveys with no birds recorded during surveys from April to July 2022. Other waders and Shelduck were also typically present in low numbers feeding (<10 birds) with the exception of Turnstone (discussed above). During passage periods all counts represented <1 of the estuary-wide WeBS five-year mean peak.

Table 10-15: Counts recorded as part of the IOH Ornithology Surveys in Sector C between between the IOT Jetty and the mudflat fronting North Beck drain as a proportion of the current estuary-wide WeBS 5-year mean peak.

Species	Winter months (October to March from 2018/19 to 2022/23)			Passage months (August to September 2021 and April to September 2022)		
	Abundance in area (feeding)*	Abundance in area (roosting)*	Counts recorded as a % of the current estuary-wide WeBS 5-year mean peak	Abundance in area (feeding)*	Abundance in area (roosting)*	Counts recorded as a % of the current estuary-wide WeBS 5-year mean peak
Black-tailed Godwit	<100 birds	<10 birds	Up to 2% (feeding) and <1% roosting	<5-10 birds	No birds recorded	<1%
Curlew†	<10-20 birds	<10 birds	<1%	<5-10 birds	1-2	<1%
Dunlin	<100 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Knot	<10-20 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Oystercatcher†	<10-20 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Redshank	<10-20 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Shelduck	<10-20 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Teal†	<20-30 birds	<10 birds	<1%	<5-10 birds	No birds recorded	<1%
Turnstone†	<20-30 birds	<20-30 birds	Up to 10% (feeding/roosting	<20-30 birds	1-2	Up to 10% (feeding/roosting
*All other species have been recorded as single individuals or very small flocks (<5 birds).						

Terrestrial Habitats (Passage and Wintering SPA/Ramsar Waterbirds)

10.6.39 Habitats within the majority of the land impacted by the pipeline route are unsuitable for coastal waterbirds, as they comprise scrub/woodland that are not suitable for high tide roosting/loafing/feeding waterbirds, and areas of land currently used for port-related storage/ operational areas.

10.6.40 The habitat within the West Site is dominated by tall-swarded grassland having been abandoned from agricultural cultivation approximately ten years ago. Consequently, the habitats within the West Site are not suitable for high tide roosting/loafing/feeding waterbirds from the nearby Humber Estuary SPA/Ramsar. This is because there is insufficient scanning distance for birds to observe approaching ground-based predators, and they therefore typically avoid taller swarded grassland. This conclusion is supported by the findings of a limited suite of wintering bird surveys undertaken to coincide with the high tide period in February and March 2022, which did not record any SPA/Ramsar waterbird species (**Appendix 10.A [TR030008/APP/6.4]**). Previous wintering bird surveys of these fields undertaken for a 2013 Drax planning application (planning reference: DM/1027/113/OUT) also did not record any SPA/Ramsar waterbirds, and the habitats were concluded to be unsuitable for waterbirds. Further survey of these habitats for wintering/passage SPA/Ramsar waterbirds was therefore scoped out and it is reasonable to conclude that the land is not functionally linked to the Humber Estuary SPA/Ramsar.

10.6.41 The large arable field adjacent to the Humber Estuary within the Temporary Compound Area off Laporte Road was identified within the PEA (**Appendix 8.B [TR030008/APP/6.4]**) as being potentially suitable for coastal waterbirds, given its proximity to intertidal feeding habitats. Surveys were undertaken across the passage and wintering period of 2022/2023[10] and the surveys did not record any locally important aggregations of SPA/Ramsar waterbirds (i.e. at numbers >1% of the WeBS five-year mean peak count). Records of SPA/ Ramsar waterbirds were limited to occasional observations of single or low numbers (<5) of curlew on three occasions. These numbers are well below 1% of the Humber Estuary WeBS five-year mean peak count for this species of curlew, which is 25 birds. It is therefore concluded that the land is not functionally linked to the Humber Estuary SPA/Ramsar. The survey results are presented in **Appendix 10.A [TR030008/APP/6.4]**.

Terrestrial Habitats (Breeding SPA/Ramsar Species)

10.6.42 There is no suitable terrestrial habitat (i.e. above Mean High Water) within the Site for breeding SPA/Ramsar species Bittern, Marsh Harrier or Avocet. Marsh Harrier has been previously recorded overflying West Site in 2013 (information contained within an ecology report submitted with planning application DM/1027/13/ OUT) but there are no extensive areas of reedbed/marsh habitat that would be suitable nesting habitat within the West Site; the reedbed habitat within the West Site is restricted to narrow bands within/on the margins of the ditches. Similarly, there are no areas of reedbed/ marsh habitat within the

[10] Terrestrial surveys were undertaken twice monthly across the High Water period between September 2022 and March 2023 inclusive.

terrestrial areas of the Site boundary suitable for breeding Bittern, and no pools suitable for breeding Avocet (the nearest known breeding habitat for Avocet is the open water/islands at Rosper Road Pools Local Wildlife Site, which is approximately 5km north of the Site). Breeding SPA/Ramsar species are therefore not considered further and are scoped out of the assessment.

Terrestrial Habitats (Breeding Non-SPA/Ramsar Species)

Desk Study

10.6.43 The Lincolnshire Environmental Records Centre desk study returned a number of records of breeding species within the study area, including five species listed on Annex I of the EC Birds Directive, 13 species listed on Schedule 1 of the Wildlife and Countryside Act (1981) (as amended) (Ref 10-13), 15 Species of Principal Importance ("SPI"), and respectively 16 Red List and seven Amber List species included in the Birds of Conservation Concern 5 ("BoCC5"). The records also include 14 species of bird that are priority species in Lincolnshire listed on the Lincolnshire Biodiversity Action Plan ("BAP").

10.6.44 Previous breeding bird surveys of the West Site in 2013 for planning application DM/1027/113/OUT recorded the following breeding species on the West Site:

a. Grassland habitat: ground nesting skylark (*Alauda arvensis*) and meadow pipit (*Anthus pratensis*).

b. Ditches: reed warbler (*Acrocephalus scirpaceus*), sedge warbler (Acrocephalus schoenobaenus) and reed bunting (Emberiza schoeniclus).

c. Boundary hedgerows: blackcap (*Sylvia atricapilla*), chiffchaff (*Phylloscopus collybita*), willow warbler (*Phylloscopus trochilus*), whitethroat (*Sylvia communis*), lesser whitethroat (*Sylvia curruca*), tree sparrow (*Passer montanus*), yellowhammer (*Emberiza citrinella*), linnet (*Carduelis cannabina*) and song thrush (*Turdus philomelos*).

Breeding Bird Survey Method

10.6.45 The Common Bird Census ("CBC") methodology was scaled down from ten to five visits during the breeding bird season; this was considered adequate to provide a good indication of the breeding bird ornithological baseline for the purposes of an assessment of ornithological impacts.

10.6.46 The surveys involved recording all the birds observed, their locations and activity/behaviour. Contacts with birds (by song, call or sighting) were marked on the survey map using BTO species codes and standard behaviour notation (Ref 10-38).

10.6.47 Surveys were undertaken during the mornings in suitable weather conditions (unrestricted visibility, winds less than Beaufort 5 and not in continuous rain). Surveys were undertaken in the following areas of terrestrial habitat within the Site Boundary:

a. West Site - 17 March, 11 April, 5 and 25 May and 21 June 2022.

b. East Site – Ammonia Storage site and Long Strip Woodland (within the Pipe Rack and Jetty Access Road site) - 3 and 31 March, 18 April, 5 May and 19 May 2023.

10.6.48 The survey maps were analysed to determine breeding activity for species of conservation concern and/or protected species according to the following categories:

a. Possible breeding – species present during the survey period in possible nesting habitat, but with no indication of breeding. Presumed passage migrants are not included.

b. Probable breeding – observations of one or more of the following activities during the survey period:

   i. singing male heard, or breeding calls heard

   ii. pair observed in suitable nesting habitat during the survey period

   iii. display or courtship

   iv. birds visiting a probable nest site

   v. birds seen to be carrying nesting material

c. Confirmed breeding – observations of any one or more of the following activities during the survey period:

   i. agitated behaviour or anxiety calls from adults suggesting a nest or young close by

   ii. distraction display or injury feigning from adults

   iii. a nest has obviously been used or eggshells found

   iv. adults seen carrying food for young

   v. adults seen carrying faecal sac away from nest site

   vi. nest with eggs

   vii. nest with young or downy young in the case of waders, game birds etc.

   viii. recently fledged young

   ix. soliciting calls from young birds

d. Non-breeding – species present during the survey period however the habitat type within the survey area is unsuitable for the particular species (for example passage migrants).

Breeding Bird Survey Results

10.6.49 Breeding bird survey results (including a map showing the assumed location of identified breeding territories) are presented in **Appendix 10.A [TR030008/APP/6.4]**, and a summary of the results is presented below.

10.6.50 The assemblage recorded within the West Site was similar to that recorded during previous surveys in 2013 (information contained within an ecology report submitted with planning application DM/1027/13/OUT).

Table 10-16: Summary of Breeding Birds Recorded on the Site

English Name	Scientific Name	Birds of Conservation Concern 5 (BOCC5)	Annex 1 of the EU Birds Directive (Annex 1)	Schedule 1 Wildlife and Countryside Act 1981 (Schedule 1)	UK Biodiversity Action Plan Priority Species (UK BAP)	NERC Act 2006	Breeding Status (Confirmed, Probable, Possible or Not Breeding)		
							West Site	East Site – Ammonia Storage site	Long Strip Woodland
Pheasant	*Phasianus colchicus*						Probable	Possible	Possible
Woodpigeon	*Columba palumbus*	Amber					Probable	Probable	Probable
Blue Tit	*Cyanistes caeruleus*						Possible	Confirmed	Confirmed
Great Tit	*Parus major*						Possible	Confirmed	Confirmed
Skylark	*Alauda arvensis*	Red			✓	s.41 species	Probable		
Cetti's Warbler	*Cettia cetti*			✓			Probable		Possible
Long-tailed Tit	*Aegithalos caudatus*						Probable	Confirmed	Confirmed
Willow Warbler	*Phylloscopus trochilus*	Amber					Probable		
Chiffchaff	*Phylloscopus collybita*						Probable	Probable	Probable
Sedge Warbler	*Acrocephalus schoenobaenus*	Amber					Probable		Possible
Reed Warbler	*Acrocephalus scirpaceus*						Probable		
Blackcap	*Sylvia atricapilla*						Possible	Probable	Probable

English Name	Scientific Name	Birds of Conservation Concern 5 (BOCC5)	Annex 1 of the EU Birds Directive (Annex 1)	Schedule 1 Wildlife and Countryside Act 1981 (Schedule 1)	UK Biodiversity Action Plan Priority Species (UK BAP)	NERC Act 2006	Breeding Status (Confirmed, Probable, Possible or Not Breeding)		
							West Site	East Site – Ammonia Storage site	Long Strip Woodland
Whitethroat	*Sylvia communis*						Probable		Possible
Wren	*Troglodytes troglodytes*	Amber					Probable	Confirmed	Confirmed
Blackbird	*Turdus merula*						Probable	Confirmed	Confirmed
Song Thrush	*Turdus philomelos*	Amber			✓	s.41 species	Probable		Possible
Robin	*Erithacus rubecula*						Probable	Probable	Probable
Meadow Pipit	*Anthus pratensis*	Amber					Probable		
Chaffinch	*Fringilla coelebs*						Probable	Probable	Probable
Linnet	*Linaria cannabina*	Red			✓	s.41 species	Probable	Not breeding	
Goldfinch	*Carduelis carduelis*						Probable	Probable	Probable
Reed Bunting	*Emberiza schoeniclus*	Amber			✓	s.41 species	Probable		
Magpie	*Pica pica*						Not breeding	Possible	
Carrion crow	*Corvus corone*						Not breeding	Possible	
Dunnock	*Prunella modularis*	Amber			✓	s.41 species	Not breeding	Possible	
Yellowhammer	*Emberiza citrinella*	Red			✓	s.41 species	Not breeding		

English Name	Scientific Name	Birds of Conservation Concern 5 (BOCC5)	Annex 1 of the EU Birds Directive (Annex 1)	Schedule 1 Wildlife and Countryside Act 1981 (Schedule 1)	UK Biodiversity Action Plan Priority Species (UK BAP)	NERC Act 2006	Breeding Status (Confirmed, Probable, Possible or Not Breeding)		
							West Site	East Site – Ammonia Storage site	Long Strip Woodland
Bullfinch	*Pyrrhula pyrrhula*	Amber				s.41 species			Possible
Buzzard	*Buteo buteo*							Possible	
Garden warbler	*Sylvia borin*								Not breeding
Goldcrest	*Regulus regulus*							Not breeding	
Great spotted woodpecker	*Dendrocopus major*								Possible
Lesser whitethroat	*Curruca curruca*								Possible
Redwing	*Turdus iliacus*	Amber						Not breeding	
Stock dove	*Columba oenus*	Amber							Possible
Swallow	*Hirundo rustica*							Not breeding	
Total number of confirmed/ probable/ possible breeding species							22	16	20

West Site

10.6.51 One probable breeding pair of the Annex I species Cetti's warbler was recorded within the West Site. Cetti's warbler, a previously rare UK species restricted to the southern region, has rapidly expanded its breeding range north and is now referred to in the Lincolnshire Bird Atlas as an "…*increasing breeding resident and passage migrant/winter visitor in Lincolnshire*" (Ref 10-39). Cetti's warbler has also been recently (in 2019) taken out of the UK Rare Breeding Birds Panel annual reports, reflecting its substantial increases in breeding numbers and range across the country. The south bank of the Humber was reported to support 93 singing males at the time of the 2021 Lincolnshire Bird Atlas publication, and it is therefore concluded to be relatively widespread in suitable habitats along the south bank of the Humber in North East/North Lincolnshire.

10.6.52 Two Red List species of high conservation concern were recorded probably breeding, with one pair each of skylark and linnet recorded within the West Site. There were seven Amber List species of moderate conservation concern recorded as probably breeding within the West Site, with sedge warbler and reed bunting being present on several of the overgrown ditches within the Site where there was an abundance of common reed to provide nesting sites for these species.

10.6.53 A total of 22 confirmed/possible/probable breeding species were recorded within the West Site. Based on the criteria published by Fuller (Ref 10-41), this assemblage would fall beneath the 'Local' significance band of 25 to 49 breeding species. As no rare or notable species were recorded, it is therefore concluded that the breeding bird assemblage is of Site value to nature conservation.

East Site – Ammonia Storage site

10.6.54 The breeding assemblage recorded within this part of the Site was limited to small numbers of common species of breeding bird, that were typically restricted to peripheral areas of more mature scrub along the boundaries of the site, and along the mature scrub boundary to Queens Road. No breeding bird species were recorded nesting on the open areas of cleared land within the central part of the site. Buzzard was recorded within the Site and may be breeding given that there is suitable habitat for nest construction, although a nest site was not identified.

10.6.55 A total of 16 confirmed/ possible/probable breeding species were recorded within the East Site – Ammonia Storage Site. Based on the criteria published by Fuller (Ref 10-41), this assemblage would fall beneath the 'Local' significance band of 25 to 49 breeding species. As no rare or notable species were recorded, it is therefore concluded that the breeding bird assemblage is of Site value to nature conservation.

Long Strip Woodland (Pipe Rack and Jetty Access Road site)

10.6.56 One possible breeding pair of the Annex I species Cetti's warbler was recorded within the northern section of Long Strip Woodland (within the few metres closest to the flood embankment). As discussed above in respect of the likely presence of this species within West Site, this species is increasing its range and is now considered widespread in suitable habitats along the south bank of the Humber in North East/North Lincolnshire.

10.6.57 A total of 20 confirmed/possible/probable breeding species were recorded within the Long Strip Woodland. Based on the criteria published by Fuller (Ref 10-41), this assemblage would fall beneath the 'Local' significance band of 25 to 49 breeding species. However, this habitat supported several less common and less widespread species that are dependent on woodland habitats for breeding, such as great spotted woodpecker, stock dove and lesser whitethroat. Furthermore, as the woodland habitat is considered relatively uncommon within this part of Lincolnshire, it is considered reasonable that the assemblage could be evaluated as of Local value to nature conservation, and this would evidence its higher value when compared to other surveyed areas within the wider Site boundary that were evaluated as of Site value only in respect of their breeding bird assemblages.

Future Baseline

10.6.58 The future baseline considers potential changes to ornithology receptors.

10.6.59 In the absence of the Project, the current marine coastal processes would remain the same as described in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

10.6.60 Coastal bird species are likely to become increasingly vulnerable to anthropogenic pressures in the future due to the predicted effects of climate change and ocean acidification in combination with more local pressures. The 2020 Marine Climate Change Impact Partnership report card (Ref 10-40) highlighted the following changes to ecology receptors could potentially occur as a result of climate change:

a. Sea-level rise could result in deeper waters and larger waves reaching saltmarsh and other intertidal habitats, causing erosion at the seaward edge.

b. Changes in patterns of rainfall or temperature changing vegetation composition of coastal saltmarsh communities.

c. Coastal waterbirds showing north-easterly shifts in the winter distributions n Europe.

d. Changes in prey distribution and availability, resulting in range shifts in some regional populations of marine mammals, fish and seabirds.

10.6.61 Data suggests that ecological changes linked to climate change (such as range shifts) are already occurring although there is currently a high degree of uncertainty with respect to predicting the magnitude of potential effects in the future.

10.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

10.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to ornithology through the process of design development, and by embedding mitigation measures into the design, such as minimising the footprint of the works as far as possible to reduce the potential loss of intertidal supporting habitat for waterbird species. The Piperack and Jetty Access Road has also been designed to minimise woodland loss within Long Strip woodland.

Standard Mitigation Measures

Impacts on Nesting Birds (construction)

10.7.2 Vegetation clearance will be undertaken outside the nesting bird season where possible, and clearance works will be avoided in the period March to August inclusive to ensure compliance with the Wildlife and Countryside Act (1981) (as amended) (Ref 10-13).

10.7.3 Where this is not possible, pre-clearance checks of vegetation would be undertaken to identify any nesting species. If occupied nests are identified, an appropriate buffer zone (at least 2m) would be established around the nest to ensure it is protected from damage/ destruction during construction. No clearance of vegetation within the buffer zone would be undertaken until any young had fledged and the nest was confirmed to be unoccupied.

10.8 Assessment of Likely Impacts and Effects

10.8.1 The assessment has identified the likely significant effects on ornithology receptors as a result of the construction and subsequent operation of the Project.

10.8.2 The Physical Processes assessment (**Chapter 16: Physical Processes [TR030008/APP/6.2]** and Water and Sediment Quality assessment (**Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**) have informed the outcomes of the ornithology assessment.

10.8.3 Potential impacts on features of internationally designated sites (SACs, SPAs and Ramsar sites) have been assessed within the **Shadow HRA [TR030008/APP/7.6]**. With respect to ornithology features of Humber Estuary SSSI, potential impacts on the following features are considered in the ES and **Shadow HRA [TR030008/APP/7.6]:**

a. Shelduck
b. Redshank
c. Black-tailed Godwit
d. Teal
e. Turnstone
f. Oystercatcher
g. Curlew

10.8.4 All other waterbird features of the SSSI have not been specifically assessed in the ES and Shadow HRA as they are considered to be rare (or only occur in very low numbers) within the Immingham area.

10.8.5 It is noted that the Killingholme Haven Pits Site SSSI which is located approximately 6km away from the Project could be functionally linked to the mudflat habitat in the Project footprint with local populations of species such as Dunlin and Black-tailed Godwit potentially utilising both areas. However, Killingholme Haven Pits is considered too distant to be impacted directly by the Project (such as through direct disturbance effects or due to the footprint of habitat loss or change). The zone of influence of indirect habitat changes as a result of changes to hydrodynamic or sedimentary processes will also not overlap with the SSSI. With respect to potential indirect effects of bird disturbance on the SSSI (e.g. changes in local population levels resulting from changes in distribution or mortality), based on the predicted magnitude of potential effects and proposed mitigation, Black-tailed Godwit and other waterbirds populations that occur at Killingholme Haven Pits SSSI would not be expected to disperse out of the Immingham area and would continue to use both the SSSI and the foreshore in the Immingham area. Furthermore, population level consequences (at both a local and fly way level) in terms of mortality or changes in breeding success is considered highly unlikely assuming the proposed mitigation for the Project (**Section 10.9**) is implemented. On this basis, the numbers of Black-tailed Godwit and other waterbirds utilising Killingholme Haven Pits would not be expected to change as a result of both direct and indirect effects due to the Project and the impact on this designated site is considered insignificant.

10.8.6 The Lagoons SSSI is located approximately 20km from the Project with Little Tern a notified feature of the SSSI. However, data suggests that this species forages within 5km of nesting sites (Ref 10-34) with this species considered very rare within the Immingham area. On this basis, this notified feature will not overlap with any potential direct or indirect changes resulting from the construction and operational activities associated with the Project which are limited to within the vicinity of the Port.

10.8.7 Cumulative impacts on ornithology receptors that could arise as a result of other coastal and marine developments and activities in the Humber Estuary combined with the Project are considered as necessary and is assessed as part of **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

Construction

10.8.8 This section contains an assessment of the potential impacts to ornithology receptors as a result of the construction phase of the Project. Potential effects during the construction phase that are considered relevant are reviewed in **Table 10-17**. It should be noted that the table includes the rationale for the scoping in or out of individual pathways for further assessment in this ES.

Table 10-17: Potential effects during construction scoped in / out of further detailed assessment

Impact Pathways Potential Effects	Project activity	Included in assessment?	Justification
Direct loss to intertidal feeding and roosting habitat as a result of the piles	Marine piling	Yes	Marine piling would result in the small loss of intertidal habitat. This impact pathway has, therefore, been scoped into the assessment.
Direct changes to waterbird foraging habitat as a result of the capital dredge and dredge disposal	Capital dredge and dredge disposal	No	The footprint of the marine capital dredge and dredge disposal sites do not overlap with the intertidal and would not cause any direct changes to intertidal feeding and roosting habitat. Capital dredging and dredge disposal at sea has the potential to cause impacts to seabed habitats which could cause changes to the prey resources available for seabirds and other diving birds. However, the seabed in the vicinity of the berth pockets and at the disposal sites are highly dynamic and subject to regular physical disturbance as a result of maintenance dredging and strong tidal currents. These areas are likely to provide a limited prey resource and are also not known to support large populations of diving birds/seabirds. This impact pathway has, therefore, been scoped out of the assessment.
Indirect changes to foraging and roosting habitat as a result of changes to hydrodynamic and sedimentary processes	Marine works (jetty structure and capital dredge)	Yes	The jetty structure and capital dredge has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns) which could cause changes to intertidal feeding and roosting habitat. This impact pathway has, therefore, been scoped into the assessment.
	Dredge disposal	No	Dredge disposal has the potential to result in changes to hydrodynamic and sedimentary processes (e.g. water levels, flow rates, changes to tidal prism, accretion and erosion patterns). The seabed in the vicinity of the disposal sites is highly dynamic and subject to regular physical disturbance as a result of maintenance

Impact Pathways Potential Effects	Project activity	Included in assessment?	Justification
			dredging and strong tidal currents. As described in more detail in **Chapter 16: Physical Processes [TR030008/APP/6.2]**, only minor changes in flow rates and subtidal seabed morphology are predicted which are not expected to modify existing subtidal habitat types found in the area (i.e. mobile sand habitats characterised by an impoverished infaunal assemblage). On this basis, these areas are likely to provide a limited prey resource and are also not known to support large populations of diving birds/seabirds. This impact pathway has, therefore, been scoped out of the assessment.
Changes to seabed habitats and species as a result of sediment deposition during marine piling	Marine piling	No	Marine piling has the potential to result in the localised resuspension of sediment as a result of seabed disturbance. The amount of sediment that settles out of suspension back onto the seabed as result of marine piling is expected to be negligible and benthic habitats and species are not expected to be sensitive to this level of change. This impact pathway has, therefore, been scoped out of the assessment for coastal waterbirds in terms of changes to supporting habitat and prey resources.
Direct loss of terrestrial habitats that are functionally linked to the Humber Estuary SPA/Ramsar	Construction	No	None of the habitats within the Site boundary are functionally linked land to the Humber Estuary SPA/Ramsar.
Direct loss of breeding bird (SPA/Ramsar) habitats	Construction	No	No suitable habitats for breeding SPA/Ramsar species are present within the Site. This impact pathway has, therefore, been scoped out of the assessment
Direct loss of breeding bird (non-SPA/Ramsar) habitats	Construction	Yes	With the exception of Long Strip Woodland, the breeding bird assemblage on the Site is evaluated to be of Site nature conservation importance and is therefore not scoped in as a relevant ecological feature for the purposes of impact assessment.

Impact Pathways Potential Effects	Project activity	Included in assessment?	Justification
			Long Strip Woodland (within the Pipe Rack and Jetty Access Road) has relatively low diversity, and thus its breeding bird assemblage is somewhat limited, although has been evaluated as being of Local importance as it is clearly of higher nature conservation value than other habitats within the Site.
Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats	Construction	Yes	During construction, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. This impact pathway is considered in more detail below.
Airborne noise and visual disturbance to coastal waterbirds using functionally linked terrestrial habitats outside the boundary of the Humber Estuary SPA/Ramsar	Construction	Yes	During construction, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds using functionally linked land. This impact pathway is considered in more detail below.
Noise and visual disturbance during capital dredge disposal	Capital dredge and dredge disposal	No	During dredge disposal, there is the potential for the dredging vessel to cause noise and visual disturbance. However, only a very small increase in vessel movements in the vicinity of the disposal site due to the capital dredge activity will occur. In addition, these areas are also not known to support large populations of diving birds/seabirds. Research has shown that disturbance to birds from vessel movements generally occurs within 50 to 100m with vessels approaching at faster speeds eliciting higher disturbance (Ref 10-42; Ref 10-43; Ref 10-44). However, it is acknowledged that some species such as Red-throated Diver and Common Scoter are considered particularly sensitive to disturbance from vessels and could be disturbed at greater distances (Ref 10-44; Ref 10-45; Ref 10-46; Ref 10-47. Any potential disturbance stimuli caused by the capital dredge disposal would be restricted to a localised area in the vicinity of the vessel for most species with even sensitive

Impact Pathways Potential Effects	Project activity	Included in assessment?	Justification
			species (such as Common Scoter) expected to be temporarily redistributed locally, rather than dispersing out of the area. In addition, vessels will only be at the disposal sites for short durations of time with any birds that might be temporarily flushed able to return to feeding following cessation of the capital dredge disposal activity. In addition, the foraging ranges of diving bird species encompasses an extensive area which will not be spatially restricted to the disposal sites which are not considered to be important foraging areas for diving bird species. In addition, it should be noted that due to the high levels of existing maintenance dredging activities within the area, seabirds and other diving birds foraging in the dredge footprint would be expected to be reasonably habituated to vessels with more sensitive species already likely to be avoiding this area. This impact pathway has, therefore, been scoped out of the assessment.

10.8.9 This section contains an assessment of the potential impacts to coastal waterbird receptors as a result of the construction phase of the Project. The following impact pathways have been assessed:

a. Direct loss to intertidal feeding and roosting habitat as a result of the piles.

b. Indirect changes to intertidal foraging and roosting habitat as a result of changes to hydrodynamic and sedimentary processes.

c. Direct loss of breeding habitat used by non-SPA/ Ramsar birds.

d. Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats and functionally linked terrestrial habitats outside the boundary of the Humber Estuary SPA/.Ramsar Site.

Direct loss to intertidal feeding and roosting habitat as a result of the piles

General scientific context

10.8.10 Coastal developments can cause a loss or change to habitats which are of functional importance for waterbirds (Ref 10-79).

10.8.11 The quality of intertidal habitat as a feeding resource for waterbirds can be highly variable both spatially and temporally (Ref 10-81). Higher energetic costs for waterbirds could occur in areas where habitat change has caused a reduction in prey distribution and density. This may affect local populations in the long-term through impacts on individual fitness (survival, body condition and fecundity) (Ref 10-82).

10.8.12 Habitat loss can also result in increased densities of birds already using a site, increasing the potential for competition (Ref 10-83; Ref 10-82). Loss or severe degradation of intertidal habitat could displace birds and cause them to redistribute either locally or to neighbouring sites (Ref 10-84). This in turn might affect the birds at those sites through competition and density-dependent mortality. Redshank displaced following the construction of an amenity barrage at Cardiff Bay (South Wales), for example, experienced a poorer body condition and had a lower survival rate after they moved (Ref 10-86). Lambeck (Ref 10-87) found that Oystercatchers displaced following large-scale habitat loss in the Delta region of The Netherlands experienced significantly higher mortality than those originally ringed elsewhere in the Delta, it is presumed as a result of the increased densities in recipient areas.

Project impact assessment

10.8.13 The piles will cause a direct loss of up to 0.00158 ha of intertidal mudflat habitat.

10.8.14 The loss of habitat represents approximately 0.000004% of the Humber Estuary SPA/Ramsar[11]. When considering this in the context of intertidal, the area of loss represents approximately 0.000018 % of intertidal foreshore habitats[12] and approximately 0.000025 % of mudflat[13] within the SPA/Ramsar.

10.8.15 This habitat loss is therefore clearly negligible in the context of the Humber SPA and Ramsar.

10.8.16 The loss of habitat due to marine piling will also be highly localised and considered de minimis in extent. The loss is also considered to be of a magnitude that will not change the overall structure or functioning of the nearby mudflats within the Port area or more widely in the Humber Estuary.

10.8.17 On this basis, any change to prey resources for birds feeding in the local area will be negligible. Individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected.

10.8.18 Based on the evidence provided above, the probability of habitat loss occurring is high, albeit minimal, but the magnitude of potential impacts is considered to be negligible. Exposure to change is, therefore, negligible. Local populations of waterbirds are considered to have a low sensitivity to the scale of habitat loss predicted. On this basis, vulnerability is assessed as none. Importance is high given the protection afforded to the supporting habitats and bird species in the area of predicted loss. On this basis, the impact is assessed as **insignificant**.

Indirect changes to intertidal foraging and roosting habitat as a result of changes to hydrodynamic and sedimentary processes

General scientific context

Background scientific context on the potential effects that habitat loss or change can have on waterbirds as a result of coastal development has already been provided above in in **Paragraphs 10.8.10** to **10.8.18**, and is, therefore, not repeated here.

Project impact assessment

10.8.19 Numerical modelling has been carried out to investigate the extent of changes to intertidal habitat from the marine works (jetty structure and capital dredge) and is presented in detail in **Chapter 16: Physical Processes [TR030008/APP/6.2]**. It should be noted that predicted changes are primarily as a result of the presence of the jetty with the effects due to the capital dredge having a negligible, localised effect.

10.8.20 Slight increases to local peak ebb current speed landward of the berth pocket are predicted to cause a limited amount of erosion of the bed along part of the lower intertidal (at the elevation of Mean Low Water Springs “MLWS”) beneath the landward ends of the proposed jetty. This will result in a potential indirect loss in

[11] Based on the extents given in the Standard Data Form on the JNCC website (Ref 10-25)
[12] Based on using the ‘Intertidal Substrate Foreshore (England and Scotland)’ data layer (Ref 10-48)
[13] Based on using mudflat data layer of the Priority Habitat Inventory (England). (Ref 10-49).

intertidal area (up to approximately 0.03 ha). The assessment indicates that once the softer upper layer is removed, the harder, more consolidated, underlayer of bed material is unlikely to erode further. This calculation represents a worst-case assessment of potential elevation changes and has been considered on a precautionary basis. The level of predicted change is at the limit of the accuracy of the modelled data and, in real terms, is likely to be immeasurable against the context of natural variability (as a result of storm events, for example).

10.8.21 This loss represents 0.00008% of the Humber Estuary SPA/Ramsar[14]. When considering this in the context of intertidal area, the area of loss represents approximately 0.00034% of intertidal foreshore habitats[15] and approximately 0.00047% of mudflat[16] within the SPA.

10.8.22 The predicted intertidal loss also consists of a very narrow strip on the lower shore around the sublittoral fringe which is considered to have limited functional value to waterbirds which utilise the foreshore in this location (such as Black-tailed Godwit, Turnstone, Curlew, Dunlin, Oystercatcher, Redshank and Shelduck) (**Table 10-15**). This is because while these species could, therefore, potentially be feeding in the predicted areas of habitat loss, during low water periods, these very small areas remain largely inundated with water and are only uncovered for a very short duration.

10.8.23 To put this into context, consideration has been given to the proportion of time that the areas of loss are available to feed over the course of a year. Based on tide gauge data at Immingham in 2020, the area of indirect loss was completely submerged for 99 % of the time. The area of indirect loss, therefore, currently provides almost no feeding opportunities for coastal waterbirds. Furthermore, the spatial extent of loss represents a barely measurable and inconsequential reduction in available habitat for these mobile species even at a local scale.

10.8.24 On this basis, it can be concluded that any change to prey resources for birds feeding in the local area will be negligible and individual survival rates or local population levels (either directly through mortality or due to birds dispersing to new feeding areas in other areas of the Humber Estuary) will not be affected.

10.8.25 Based on the evidence provided above, the probability of habitat loss occurring is high, albeit minimal, but the magnitude of potential impacts is considered to be negligible. Exposure to change is, therefore, negligible. Local populations of waterbirds are considered to have a low sensitivity to the scale of habitat loss predicted. On this basis, vulnerability is assessed as none. Importance is high given the protection afforded to the supporting habitats and bird species in the area of predicted loss. On this basis, the impact is assessed as **insignificant**.

Direct loss of breeding bird (non-SPA/ Ramsar) habitats

10.8.26 The loss of woodland within Long Strip will result in an adverse effect on breeding birds, due to the permanent nature of the habitat impacts and thus the permanent displacement of nesting pairs.

[14] Based on the extents given in the Standard Data Form on the JNCC website Ref 10-25
[15] Based on using the 'Intertidal Substrate Foreshore (England and Scotland)' data layer
[16] Based on using mudflat data layer of the Priority Habitat Inventory (England)

10.8.27 Based on the relatively limited diversity of the woodland habitats and the generally low numbers of common species of breeding birds, the breeding bird assemblage is evaluated to be of Local value to nature conservation. It is therefore assessed that the permanent loss of breeding bird territories within the woodland will result in a **moderate adverse** effect, that would be **significant** (Local level).

Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats

General scientific context

Introduction

10.8.28 Disturbance can cause birds to cease feeding, which can decrease the total amount of time available for feeding, as well as disrupting other behaviour such as breeding (Ref 10-89; Ref 10-96). Where disturbance causes birds to take flight, it can increase energy demands and may increase food consumption by decreasing the available habitat area (Ref 10-93; Ref 10-95; Ref 10-99). Repetitive disturbance events can result in possible long-term effects such as loss of weight, condition and a reduction in reproductive success, leading to population impacts (Ref 10-91; Ref 10-92; Ref 10-90). Birds typically show a dispersive response to disturbance with prolonged disturbance causing displacement (Ref 10-93; Ref 10-67; Ref 10-97).

10.8.29 Disturbance often occurs through a combination of simultaneous visual and noise stimuli, although some occurrences may be through separate visual or noise stimuli (Ref 10-101). Birds will also vary their response to human activities depending on the type of the activity, the noise produced, the speed and randomness of approach, the distance to which the disturbance factor approaches and the frequency of disturbance (Ref 10-88, Ref 10-98; Ref 10-94; Ref 10-89; Ref 10-64; Ref 10-100).

Disturbance response associated with construction activity

10.8.30 Construction activity in the coastal zone may lead to disturbance which has the potential to cause a reduction in foraging activity as well as temporary displacement from a localised area around the works (Ref 10-88).

10.8.31 Overall, responses to construction noise and activity appear to initiate similar or less disturbance than that of human presence on the foreshore (e.g. recreation) (Ref 10-102; Ref 10-51; Ref 10-50; Ref 10-55). For example, while some localised disturbance was caused as a result of piling activity as part of the construction work for ABB Power Generation Ltd (Pyewipe, Grimsby), this was not considered to have a major effect on surrounding bird populations and was found to be no greater than the effect arising from third party disturbance, including walkers and stopped cyclists, which were unrelated to the ABB works (Ref 10-102). The greater effect of human presence as opposed to general construction works and machinery is also supported by Institute of Estuarine Coastal Studies (“IECS”) (Ref 10-50), in that a person approaching feeding birds on the mudflat caused birds to fly when the person was approximately 300m from

the birds, whereas machinery could approach birds up to 50m before the birds moved away.

10.8.32 Lower levels of disturbance for construction activities compared with other nearby human activity was also observed during bird monitoring as part of the marine licensing consent for a quay wall construction development at the Port of Southampton. The study evaluated the disturbance effects of the extension work on waterbird species using the mudflat habitat on Bury Marsh opposite the Port of Southampton (approximately 100 to 200m away) during the overwinter period. No bird disturbance behaviour (such as startling, rapid flight or abruptly stopping foraging) was observed during periods of percussive piling activity. However, disturbance to waterbirds was observed on several occasions due to vessels and kayaks within 50 m of Bury Marsh (Ref 10-51).

10.8.33 Studies into the distances from activities that evoke a disturbance response suggest that for most coastal works and other foreshore activity in areas where birds are likely to be habituated to some extent to disturbance due to existing anthropogenic activity, disturbance behaviour is not typically observed when activities occur more than some 200m away from a source with the reactions of many species occurring between 20 and 100 m (Ref 10-63; Ref 10-64;Ref 10-62; Ref 10-65; Ref 10-66; Ref 10-67; Ref 10-55; Ref 10-68; Ref 10-56; Ref 10-59; Ref 10-57; Ref 10-51). This is discussed in more detail below in **Paragraph 10.8.42** and **Table 10-19**.

10.8.34 Construction techniques which are known to cause loud source noise levels (such as piling) have been the subject of a number of disturbance monitoring studies which have investigated the relationship between activity source levels and the disturbance responses elicited by birds (Ref 10-62; Ref 10-103; Ref 10-101; Ref 10-63; Ref 10-55). Research suggests that irregular impulsive construction noise at levels typically above 70 dB can cause behavioural responses in some waterbird species with flight responses generally occurring above 80 dB (**Table 10-18**). However, responses of birds will be dependent on a range of site-specific factors including ambient (background) noise levels, time of year, levels of existing activity and the species assemblage and the birds become habituated to new noise source. In addition, visual disturbance associated with construction activity will often create a disturbance effect before any associated noise starts to have an effect (Ref 10-55).

Table 10-18: Summary of noise disturbance studies

Study	Summary
IECS (Ref 10-62); IECS (Ref 10-66)	A study of coastal construction noise effects on the Humber Estuary was undertaken based around the measurement of noise levels while simultaneously monitoring the behavioural response by birds during flood defence works at Saltend. The defence works involved the use of a double hydraulic pile on site. The study noted a moderate to high behavioural response to irregular piling noise above 70 dB and a moderate response to regular piling noise below 70 dB. A flight response was noted to occur during works generating

Study	Summary
	noise at between 80-85 dB. Behavioural responses, notably the down-shore movements of wildfowl were noted above 70 dB. Noise levels between 55 dB and 84 dB were generally accepted by birds. Other impacts associated with construction included a high response to personnel and plant equipment on the mudflat and a moderate to high response to personnel and plant equipment on the seaward toe and crest. Occasional movement of a crane jib and load resulted in a low to moderate response. Noises below 50 dB, long-term plant activities only on the crest and activity behind the flood bank elicited a low response.
Xodus (Ref 10-103)	Monitoring of birds as part of the Grimsby River Terminal Project found that noise from construction (including piling) caused only 1% of the disturbance events observed, with large disturbances mainly caused by the presence of raptors, aircraft and helicopters. The study concluded that percussive piling noise less than 66 dB LA_{max} F gave rise to no disturbance, whilst a mild behavioural response (such as heads up alert, short walk or swimming) was observed to occur in the range of 73 to 81 dB LA_{max} F. Percussive piling noise over 83 dB LA_{max} F was considered likely to evoke a flight response.
Wright *et al* (Ref 10-101)	The experimental study intentionally disturbed birds at a high tide roost site, on the south bank of the Humber estuary using an impulsive sound similar to that associated with noise from port and power generation construction such as percussive piling and recorded the behavioural responses. Lapwing appeared to be the species most sensitive to intentional disturbance, while Curlew was the most tolerant. The study recommended that impulsive noise limits should be restricted to < 69.9 dB at the site.
ABPmer (Ref 10-63)	Disturbance monitoring of waterbirds in the vicinity of construction works (piling and dredging) at the ABP Teignmouth Quay Development concluded that sudden noise in the region of 80 dB appears to elicit a flight response in waders up to 250m from the source, with levels of approximately 70 dB causing flight or anxiety behaviour in some species.

Species sensitivity and response

10.8.35 Birds generally appear to habituate to continual noises as long as there is no large amplitude ‘startling’ component (Ref 10-104). With specific respect to piling, it has been concluded that although piling has the potential to create most noise during construction it often consists of rhythmic “bangs”, which birds might become accustomed to depending on the distance that birds are away from the

piling (Ref 10-105). For example, observations as part of the construction work for ABB Power Generation Ltd (Pyewipe) suggested that it was the initial sudden bang during piling activities, which caused some localised disturbance, and that subsequent bangs typically resulted in reduced disturbance, demonstrating habituation (Ref 10-102).

10.8.36 The level of response to potential disturbance stimuli also varies considerably between species with some ducks (such as Shelduck) and larger waders such as Curlew, Grey Plover and godwits generally showing stronger responses to disturbance stimuli than smaller waders (such as Turnstone and Dunlin) (Ref 10-56; Ref 10-57; Ref 10-58; Ref 10-55; Ref 10-59; Davidson and Rothwell, (Ref 10-106). A detailed review of the responses and sensitivity of key waterbird species to noise and visual disturbance is presented in **Table 10-19**. This includes data on flight initiation distance ("FID") which is the distance at which a bird takes flight in response to a perceived danger and is used to help better understand the relative sensitivity of different species to disturbance.

10.8.37 The response to disturbance is also dependent on the previous experience of the birds to disturbance (i.e. level of habituation) as well as a range of other factors such as environmental conditions, their state at the time of the disturbance (e.g. hungry or satiated) and the quality of their alternative foraging sites (Ref 10-60; Ref 10-61; Ref 10-62; Ref 10-56).

10.8.38 It is also important to understand potential behavioural responses of disturbance in the context of energetic costs, mortality and population consequences as some disturbance has been shown to have limited adverse effects on waterbirds. For example, Goss-Custard *et al*. (Ref 10-92) used an individual-based behavioural model to establish critical thresholds for the frequency with which wading birds can be disturbed before they die of starvation. The model was tested on oystercatchers in the Baie de Somme, France, where birds were put to flight by disturbance up to 1.73 times/daylight hour. The modelling results showed that the birds could be disturbed up to 1.0 to 1.5 times/h before their fitness was reduced in winters with good feeding conditions (abundant cockles and mild weather) but only up to 0.2 to 0.5 times/h when feeding conditions were poor (scarce cockles and severe winter weather).

Table 10-19: Summary of evidence of the sensitivity for different key species to noise and visual disturbance stimuli

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
Shelduck	Shelduck are generally a wary species and are considered particularly sensitive to visual disturbance. Typically, they approach construction works no closer than 300m and can be affected by visual disturbance up to 500m away from source (Ref 10-55). Noise disturbance has been reported from 72 dB upwards for Shelduck. However, the species is subject to a high degree of habituation and further exposure to sounds of the same or greater level can lead to no response to stimuli. No response has been recorded for noise levels as high as 88 dB, but this is likely to be an extreme 'no response' level and caution should be exercised at receptor levels over 70 dB. Observation of disturbance responses from flood protection works has suggested that Shelduck react to noise in approximately 30% of exposure events to sudden noise above 60 dB or any noise above 70 dB (Ref 10-55). Goodship and Furness (Ref 10-57) assessed Shelduck as having a high sensitivity to human disturbance with the range in mean FID from the literature reviewed of 36m to 250m as a result of the presence of people on or near the foreshore although FIDs up to 700m have been recorded. Goodship and Furness (Ref 10-59) undertook a disturbance literature review and assessed Shelduck	Moderate to high

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
	as one of the species considered most sensitive to disturbance stimuli with the range in mean FID from the literature reviewed of 148m to 250m as a result of the presence of people on or near the foreshore.	
Curlew	Research evidence indicates that Curlew are a cautious species that does not habituate to works rapidly and are also particularly intolerant of people, allowing approach to a range of typically 120-300m before flushing (Ref 10-55); Ref 10-107). Goodship and Furness (Ref 10-57) assessed Curlew as having a high sensitivity to human disturbance with the with the range in mean FID from the literature reviewed of 38m to 340m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 140m and motorised vehicles 188m. Collop *et al., (Ref 10-56*) recorded a minimum FID of 88m and a maximum FID of 570m (with a mean of 340m) for this species through experimentally disturbing foraging birds (approaching a total of 39 times) as part of a research study. Goodship and Furness (Ref 10-59) undertook a disturbance literature review and assessed Curlew as one of the species considered most sensitive to disturbance stimuli with the range in mean FID from the literature reviewed of 38m to 340m as a result of the presence of people on or near the foreshore with motorised vessels having a mean FID of 140m.	Moderate to high

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
Black-tailed Godwit	Disturbance responses have been recorded at distances over 100m from construction activity (Ref 10-55)). Goodship and Furness (Ref 10-57) found evidence of FIDs between 20 and 150m as a result of presence of people on or near the foreshore from the literature reviewed in the study. This study also considered this species to have a relatively high tolerance towards human disturbance and appear to be able to habituate to human activities. The study concluded that a buffer zone of 100-200m was considered appropriate with respect to disturbance in the non-breeding season. Burton *et al.* (Ref 10-77) also considered overwintering Black-tailed Godwit to be one of the most tolerant species to potential disturbance with a 200m zone recommended to avoid disturbance to this species (and other waterbirds). Gill *et al.* (Ref 10-116) found no evidence that human presence reduced the number of Black-tailed Godwits with the authors finding that the presence of infrastructure (as such as marinas/small ports or footpaths) did not impact the number of godwits supported by the food supply on the adjacent mudflats. This study compared marinas/ports against reference sites that contained similar sediment type and fauna but was far enough away (>200m) to be considered unaffected by human activity at a marina. A study investigating human disturbance on Black-tailed Godwit, Curlew and Teal in Co. Cork, Ireland, found that out of the three species, Black-tailed Godwits were the least affected by disturbance events and were likely to move <50m	Moderate

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
	from their original position when a disturbance event occurred (Ref 10-115). Specifically on the Humber Estuary, Percival Ref 10-117) found that Black-tailed Godwits in the Humber Estuary appear to be tolerant of a relatively high disturbance environment. Percival (Ref 10-117) found that Black-tailed Godwits roost at high tide on the North Killingholme Haven Pits which are located in an area adjacent to port infrastructure. There was no evidence found in this study that industrialisation had reduced the ability of the pits to support the godwit population.	
Oystercatcher	Oystercatchers are relatively tolerant of disturbance stimuli and will habituate rapidly to ongoing activity. In undisturbed areas they will often flush at great ranges but in more disturbed locations such as a typical estuary, this figure reduces to typically between approximately 25-200m dependent upon the stimuli (with people causing the most extreme reaction) (Ref 10-55). Collop *et al., (Ref 10-56*) recorded a minimum FID of 30m and a maximum FID of 228m (with a mean of 97m) for this species through experimentally disturbing foraging birds (approaching a total of 147 times) as part of a research study. Goodship and Furness (Ref 10-59) and Goodship and Furness (Ref 10-57) undertook disturbance literature reviews and assessed Oystercatcher as being of moderate sensitivity to disturbance stimuli with the range in mean FID from the literature reviewed of 26m to 136m as a result of the presence	Moderate

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
	of people on or near the foreshore with motorised vessels having a mean FID of 74m and motorised vehicles a mean FID of 106m.	
Teal	Bregnballe *et al* ., (Ref 10-118) found most disturbance responses to this species were within 150 m with limited responses at greater distances. Mayor *et al.,* (Ref 10-119) recorded a mean FID of 169m during an experimental disturbance study.	Moderate
Redshank	Redshank are considered a relatively tolerant species to visual stimuli (and will often approach much closer than 100m before flushing (sometimes as close as 30-50m)) but can be sensitive to noise stimuli. They are also considered to habituate to works rapidly (Ref 10-55)). Collop *et al., (Ref 10-56*) recorded a minimum FID of 28m and a maximum FID of 187m (with a mean of 80m) for this species through experimentally disturbing foraging birds (approaching a total of 53 times) as part of a research study. Goodship and Furness (Ref 10-57) assessed Redshank as having a moderate sensitivity to human disturbance with the range in mean FID from the literature reviewed of 4 to 150m as a result of the presence of people on or near the foreshore. Goodship and Furness (Ref 10-59) undertook a disturbance literature review and assessed Redshank as being relatively sensitive to disturbance stimuli with the range in mean FID from the literature	Low to moderate

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
	reviewed of 24m to 137m as a result of the presence of people on or near the foreshore.	
Dunlin	Dunlin appear to be a species relatively tolerant to visual stimuli and are considered to habituate to people with most responses occurring in <75-100m of visual stimuli. Dunlin have been recorded foraging extremely closely to plant (<50m) and >75m from worker. When foraging, they can be initially disturbed by activity start-up, with a flight response, but will then forage back towards construction works, approaching to within 25m on occasion, before sometimes flushing and moving away again, to repeat the process (Ref 10-55)). Collop *et al., (Ref 10-56*) recorded a minimum FID of 9m and a maximum FID of 194m (with a mean of 44m) for this species through experimentally disturbing foraging birds (approaching a total of 117 times) as part of a research study (Ref 10-55)). Goodship and Furness (Ref 10-59) and Goodship and Furness (Ref 10-57) undertook disturbance literature reviews with the evidence reviewed suggesting that Dunlin is less sensitive to disturbance than many other waders with the range in mean FID from the literature reviewed of 39m to 163m as a result of the presence of people on or near the foreshore.	Low
Turnstone	Turnstone are considered not very sensitive to noise stimuli and habituate rapidly, especially in conjunction with visual stimuli. They are tolerant of	Low

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
	people/workers and plant, allowing approach as close as 30-50m before flushing. Direct observation of disturbance effects from works found Turnstone responses to be consistent with the expected high tolerance, with birds allowing approach to works to within 10m before reacting. This was in a highly disturbed area with much public use of the foreshore and of 127 potential disturbance events observed, only 19 caused reaction of which only three were caused by the works with trucks flushing Turnstones at between 15-100m. Walkers (and dog walkers in particular) caused the greatest reactions. There was no evidence of reactions to noise, which reached levels above 90 dB due to piling (Ref 10-55). Collop *et al.,* (Ref 10-56) recorded a minimum FID of 5m and a maximum FID of 75 m (with a mean of 32m) for this species through experimentally disturbing foraging birds (approaching a total of 40 times) as part of a research study. Goodship and Furness (Ref 10-59) undertook a disturbance literature review with the evidence suggesting that Turnstone is less sensitive to disturbance than many other waders with the range in mean FID from the literature reviewed of 12.5m to 39m as a result of the presence of people on or near the foreshore.	

Species	Sensitivity to noise and visual disturbance	
	Evidence on the sensitivity to disturbance stimuli	Sensitivity level[1]
1. The assigned sensitivity levels have been based on available evidence with respect to responses to disturbance stimuli. For some species a range in sensitivity has been presented where evidence suggests large variations in intraspecific responses due to various factors which could influence sensitivity (such as the type of activity, site specific factors such as habituation, environmental conditions and site fidelity etc). Where information is limited a precautionary sensitivity level has been assigned.		

10.8.39 Collop *et al.,* (Ref 10-56) looked into the likely consequences of different frequencies of disturbance on various wading birds, using their data on mean flight time and mean total time lost. The authors found that a 5% reduction in birds' daily available feeding time would be expected to result from responding to between 38 and 162 separate disturbance events (depending on species and tidal stage). The mean cost per individual flight response represented less than a tenth of a Per cent of each species' daily energy requirements. The study concluded that the energetic costs of individual disturbance events, were low relative to daily requirements and unlikely to be frequent enough to seriously limit foraging time.

Review summary

10.8.40 Within the Site, the level of disturbance stimuli is dependent on the type of activity being undertaken. In general, human presence on or near the foreshore (e.g., walking) is considered to cause greater disturbance than vehicles or watercraft and waterbirds are more easily disturbed by irregular movements than the regular and defined presence of machinery, vessels and other vehicles (Ref 10-50 Ref 10-51; Ref 10-52; Ref 10-53; Ref 10-54). High level responses to noise (such as dispersal away from marine works) are typically associated with sudden or irregular noise over 70-80 dB (at the receiver (i.e. bird) location not the noise source) (Ref 10-62; Ref 10-103; Ref 10-101; Ref 10-63; Ref 10-55).

10.8.41 The specific responses that waterbirds will have to disturbance varies between species as well as between birds of the same species due to a range of factors including the level of habituation and environmental conditions (Ref 10-60; Ref 10-61; Ref 10-62; Ref 10-56).

10.8.42 Distances over 300 m have been recorded more occasionally for some sensitive species such as Curlew or Shelduck (Ref 10-55); Ref 10-56; Ref 10-59; Ref 10-57). However, evidence from the detailed review above suggests, that waterbirds generally show a flight response to anthropogenic activities such as construction and a presence of people (such as workers) on or near the foreshore at distances of typically less than 200m (and more typically between 20m and 100m for certain species such as Turnstone or Dunlin) in areas where birds are likely to be habituated to some extent to disturbance due to existing human activity (Ref 10-63; Ref 10-64;Ref 10-62; Ref 10-65; Ref 10-66; Ref 10-67; Ref 10-55); Ref 10-68; Ref 10-57; Ref 10-56; Ref 10-59; Ref 10-51).

Project impact assessment

10.8.43 The bird data suggest that the foreshore fronting the Project (i.e. the section of Sector C between the IOT Jetty and the mudflat fronting North Beck drain within approximately 400-500m of the Project) is regularly used by a variety of feeding and roosting waterbirds as summarised in **Section 10.6** and **Table 10-15**. In an estuary wide context, numbers of most species recorded in this area were generally low. NE advised that birds exceeding 1% of the estuary-wide WeBS five-year mean peak is viewed as significant numbers. When compared to estuary-wide numbers, feeding Black-tailed Godwit during the winter and Turnstone (both feeding and roosting) represent up to 2% and 10% respectively of the estuary-wide WeBS five-year mean peak (2017/18 to 2021/22). Counts of other species represent <1 of the estuary-wide WeBS five-year mean peak.

During passage and summer months, only Turnstone was present in numbers exceeding 1%.

10.8.44 Noise stimuli caused by the vibro and percussive marine piling activity and the presence of jack-up or crane barges (causing both potential noise and visual disturbance stimuli) as well as other construction machinery, construction workers and plant activity are all potential sources of disturbance associated with construction of the approach jetty.

10.8.45 The evidence reviewed above suggests that the response of waterbirds to disturbance stimuli is relatively limited at distances over 200m, particularly in areas subject to already high levels of existing anthropogenic activity (as found in the Port area). This detailed review has considered an extensive amount of research and reviews on FID – the distance at which a bird takes flight in response to disturbance stimuli – as well as studies that have investigated the distance that birds respond to construction activity (or other analogous activities undertaken on the foreshore such as the construction of flood defence works). The use of a 200m buffer zone has been considered appropriate when considering disturbance effects for a number of assessments and research studies (such as Burton et al., Ref 10-77 for waterbirds generally including sensitive species such as Shelduck and also Gill *et al*., Ref 10-116 and Goodship and Furness (Ref 10-57) with specific respect to Black-tailed Godwit). Specifically for the Humber Estuary, Ross and Liley (Ref 10-68) stated that based on previous studies, a distance of 200m '*represents a distance well beyond the distance at which birds are likely to respond'*. This was considered applicable to both tolerant and sensitive species including Shelduck. The study also concluded that the probability of birds being flushed declined with distance (i.e. how far away the activity was from the bird), such that the probability of birds being flushed when activities are beyond 100m away is very low. The study was focused on recreational activity but also recorded disturbance associated with other activities including industry. As stated in in the review above, recreational disturbance (such as dog walking) is considered to cause greater or similar responses to that of port related disturbance.

10.8.46 The conclusions reached are supported by site specific evidence which suggests that birds continue to feed in the Port area within 200m of relatively noisy port activity and visual stimuli without being displaced and direct observations of construction type activity occurring within the Immingham area. Recent (January to March 2023) disturbance monitoring of the IERRT Ground Investigation ("GI") works confirm that disturbance responses of waterbirds at distances of more than 200m are limited, specifically for waterbirds on the Immingham foreshore with bird numbers and distribution also on the local foreshore broadly comparable to what has been recorded in ongoing waterbird surveys in this area over the last five-years[17]. These birds appear to be tolerant of disturbance stimuli. A jack-up

[17] Coastal waterbird species (Dunlin, Redshank, Turnstone, Black tailed Godwit, Mallard, Shelduck, Herring Gull, Common Gull and Black-headed Gull) were all recorded actively feeding within 60 m of the jack-up-barge and closer on occasion. In addition, bird numbers and distribution in the eastern section of Sector B (i.e., the foreshore fronting Immingham Docks, from the lock gate towards the IOT Jetty) – where the GI

barge was used during the GI works which will also be used for the Project during construction; therefore, the construction plant will be similar in terms of visual presence.

10.8.47 With specific respect to noise stimuli, NE provided advice as part of the consultation for the proposed IERRT project which stated that '*peak levels below 55 dBA can be regarded as not significant, while peak noise levels approaching 70 dBA and greater are most likely to cause an adverse effect.' Therefore, levels over 65.5 dBA may cause disturbance to SPA birds. Birds may habituate to regular noise below 70 dBA, but irregular above 50 dBA should be avoided*'. It is also worth noting that visual disturbance associated with anthropogenic activity will in some situations create a disturbance effect before any associated noise starts to have an effect particularly in those species sensitive to visual stimuli (Ref 10-52; Ref 10-108; Ref 10-55)).

10.8.48 On this basis the assessment has been based on consideration of a 200m potential disturbance zone and noise level guidance provided by NE described above.

10.8.49 The assessment focuses on potential disturbance to waterbirds on or near the foreshore due to approach jetty construction. It should be noted that construction of the Jetty head will occur at distances of more than 1km from the foreshore. In addition, capital dredging of the berth will also be undertaken at distances of more than 1km from the foreshore. On this basis, responses are considered unlikely even in more sensitive species on the foreshore and these elements of construction are not assessed further.

10.8.50 Ambient noise levels collected for the Applicant's separate 'Immingham Eastern Ro-Ro Terminal' ("IERRT") project (on the port land to the east and north of the Site Boundary) on the foreshore around the Port have been used in this assessment. Unattended noise measurements over five days in July 2022 suggest a range of ambient noise levels between 42 to 58 dB LAeq,1 hr and the existing range of Lmax noise levels is 48 to 84 dB *L*max. During percussive marine piling associated with the Project, noise levels above 70 dB *L*max are predicted within approximately 645m of the marine piling rigs and over 80 dB *L*max within approximately 205m in the absence of noise reducing controls (**Figure 10.5 [TR030008/APP/6.3]**).

10.8.51 In addition, in order to better understand potential zones of disturbance, **Figure 10.6 [TR030008/APP/6.3]** presents a 200m buffer zone. The figure also shows MLWS and Mean Low Water Neaps ("MLWN") so that the extent of foreshore within and outside of the buffer under different tidal states can be better understood.

Works were undertaken for the period of the GI works were also broadly comparable to what has been recorded in ongoing waterbird surveys in this area over the last five-years. Therefore, in summary, coastal waterbirds tolerated the noise and visual stimuli associated with the GI works with only very limited disturbance observed and birds continued to utilise the foreshore in Sector B in similar numbers to previous years

10.8.52 Waterbirds present in the area will be habituated to some extent to anthropogenic activities (due to existing port operations) near the foreshore such as vessel and vehicle movements, port related noise and human activity. Nevertheless, avoidance responses or dispersive disturbance events (resulting in the redistribution of waterbird flocks to nearby areas) may occur relatively frequently during approach jetty construction on or near to the foreshore for any flocks present in this area.

10.8.53 Responses would be expected to be greatest for species considered more sensitive to bird disturbance such as Black-tailed Godwit, Redshank, Curlew and Shelduck (**Table 10-19**). Less sensitive species such as Dunlin, Turnstone and gulls would be expected to be disturbed to a lesser degree and feed closer to construction activity.

10.8.54 It is not anticipated, however, that birds will be displaced from the local area completely, in that the birds would be expected to redistribute to nearby foreshore in the Immingham/Grimsby area and continue to feed and roost in these alternative locations following dispersal with the zone of potential disturbance very small in the context of the Humber Estuary SPA/Ramsar. The 200m buffer, for example only represents 0.023% of the SPA/Ramsar and 0.10% of intertidal foreshore habitats and specifically 0.14% of mudflat within the SPA. In addition, while energetic costs might be increased slightly due to disturbance, the research reviewed above suggests that the energetic costs of individual disturbance events would be expected to be relatively low and even relatively frequent disturbance could potentially only cause a small reduction in the time available in a day for feeding. In addition, birds are known to forage nocturnally and might potentially change foraging patterns to utilise the area during nocturnal periods when limited construction activity is occurring.

10.8.55 For all the construction activities, it is also recognised that during cold periods, coastal waterbirds are more susceptible to disturbance due to higher energetic costs and greater feeding requirements for thermoregulation. Furthermore, very cold winter weather can cause mudflats and adjacent functionally linked terrestrial habitats used for feeding (such as agricultural land and wet grassland) to freeze. In addition, cold conditions can also cause an influx of waterbirds from continental Europe which have flown to Britain to escape from even colder conditions. This can further increase competition for feeding resources in an area. The increased difficulty obtaining enough food and greater energy required for thermoregulation can in some situations cause reduced survival rates and appear to make birds seem more tolerant to disturbance as birds avoid using excess energy reserves (Ref 10-92; Ref 10-109, Ref 10-110; Ref 10-56; Ref 10-111).

10.8.56 In summary, the probability of noise and visual disturbance stimuli occurring during construction is likely to be high. As described above, disturbance at a level which could cause dispersive responses and relatively localised displacement of coastal waterbirds is likely with respect to construction activity associated with the approach jetty. However, the foreshore in the vicinity of the approach jetty is used by relatively low numbers of waterbirds. The magnitude of change for all commonly occurring waterbirds in the area is, therefore, considered to be low. The sensitivity of coastal waterbirds in the area is considered to range from low

to moderate-high depending on the species (**Table 10-19**). Importance is considered to be high for all species because of the protection afforded to coastal waterbirds. Therefore, the potential effects of temporary disturbance during construction in has been assessed as **minor adverse** (low sensitivity species) **to moderate adverse** (moderate to high sensitivity species).

Operation

10.8.57 This section contains an assessment of the potential impacts to ornithology receptors as a result of the operational phase of the Project. These effects have been reviewed in **Table 10-20**. This section includes an explanation of the rationale that was adopted for scoping in or out individual pathways for further assessment.

Table 10-20: Potential effects during operation scoped in/out of further detailed assessment

Receptor	Impact Pathways/Potential Effects	Project activity	Included in more detailed assessment?	Justification
Coastal waterbirds	Direct changes to intertidal foraging and roosting habitat as a result of marine infrastructure	Berth operations	Yes	Marine infrastructure associated with the Project (such as the raised jetty structure) could potentially cause direct damage or reduced functionality to waterbird feeding and roosting habitat. It should be noted that this pathway relates to potential changes to foraging and roosting habitat as a result of the physical presence of marine infrastructure rather than the direct loss of intertidal mudflat habitat due to the infrastructure (i.e. the piles) which would be assessed in the construction phase. It should also be noted that this pathway specifically relates to the structures themselves rather than human activity on the infrastructure which is assessed in the disturbance pathway below. However, it is acknowledged that such effects are likely to be interrelated to some extent. This impact pathway is considered in more detail below.
	Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats	Berth operations	Yes	During operation, there is the potential for airborne noise and visual disturbance to affect coastal waterbirds. This impact pathway has, therefore, been scoped into the assessment.

10.8.58 This section contains an assessment of the potential impacts to coastal waterbird receptors as a result of the operational phase of the Project. The following impact pathways have been assessed:

a. Direct changes to intertidal foraging and roosting habitat as a result of the presence of the infrastructure; and

b. Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats.

Direct changes to intertidal foraging and roosting habitat as a result of the presence of infrastructure

10.8.59 For clarity it should be noted this pathway relates to potential changes to foraging and roosting habitat as a result of the physical presence of marine infrastructure. The direct loss of intertidal mudflat habitat due to the presence of the infrastructure (i.e. the piles) was assessed in the construction phase (**Paragraphs 10.8.10** to **10.8.18**).

10.8.60 It should also be noted that this pathway specifically relates to the structures themselves rather than human activity on the infrastructure which is assessed in the disturbance pathway below. However, it is acknowledged that such effects are likely to some extent to be interrelated.

General scientific context

10.8.61 Waterbirds often show a preference for foraging in open spaces with clear sightlines when feeding so that scanning distances can be maximised. On this basis, certain species of coastal waterbirds might show a reluctance to approach tall anthropogenic structures or those that create enclosed spaces. One of the main reasons for not approaching a structure is thought to be the same as waders avoiding feeding near high banks, tall hedges/trees and in enclosed spaces (such as small fields surrounded by trees) (Ref 10-73), i.e., they are trying to avoid any sudden attack by a predator that may be hiding in or behind the structure. Just as raptors often exploit tall structures to aid prey detection, species that may be targeted by raptors would naturally avoid tall structures to minimise predation risk. Many waders and waterfowl may avoid areas in which their sightlines are reduced, even though in certain circumstances this may reduce the quantity of high-quality foraging habitat available to them or access to important roosting sites. However, it is often difficult to separate the direct impact of the structure from other factors associated with development, such as human activity causing potential disturbance stimuli (assessed below in **Paragraphs 10.8.66** to **10.8.76**) (Ref 10-74).

10.8.62 The addition of anthropogenic structures to coastal waters can also result in a new habitat for colonising epibiota (such as mussels, periwinkles, limpets and barnacles) which are considered prey items for certain wading birds such as Turnstone, Oystercatcher and Purple Sandpiper. Certain species (such as Turnstone) are also regularly recorded feeding on epifaunal species which have colonised anthropogenic structures in the intertidal such as jetties and coastal defences (Ref 10-75). Coastal waterbirds also regularly roost on a variety of artificial structures in harbours and ports including pontoons, platforms, sea walls and dolphins (mooring structures) (Ref 10-112; Ref 10-113; Ref 10-69). Species

commonly recorded in the UK using such structures include gulls, Cormorants and waders such as Dunlin, Turnstone and Oystercatchers. Factors that can influence the level of use by waterbirds of artificial roosting structures include the proximity to nearby feeding grounds, the level of human disturbance and perceived predator risk.

Project impact assessment

10.8.63 Marine infrastructure associated with the Project (raised jetty structure etc.), will not prevent any direct access to established roosting habitat used by coastal waterbirds in the area. In addition, shading caused by the structures would not be expected to cause significant changes to benthic prey resources used by coastal waterbirds as assessed in Section 9.8 of **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2].**

10.8.64 The approach jetty will be an open piled structure with large gaps between each of the piles and between the jetty deck and the foreshore seabed (i.e. the mudflat surface). This will minimise the enclosed feel and allow birds feeding near the structure to maintain sightlines. It should be noted that observations from the ornithology surveys in the area suggest that birds regularly feed in very close proximity to both the Eastern Jetty (approximately 1km from the Project) and the IOT approach jetty (approximately 500m from the Project) – which are both similar open piled structures - with species such as Redshank, Dunlin, Turnstone regularly recorded underneath jetties and Curlew, Shelduck and Black-tailed Godwit approaching them closely (<10-20m). However, a review of bird distribution data for Sector C (for the period 2018/19 to 2021/22) found that the densities of coastal waterbirds (including Black-tailed Godwit, Shelduck, Dunlin and Redshank) were typically either higher or broadly comparable on the foreshore near to the existing IOT jetty (<100-150m) compared to greater distances away (approximately 150 m to 1km). There is therefore unlikely to be a change the overall distribution of waterbirds more widely along the foreshore fronting Immingham in this area.

10.8.65 Based on the above, birds would be expected to feed below or very close to the Project's approach jetty and indeed other infrastructure on the foreshore – none of which will prevent direct access to established roosting habitat. As a consequence, any avoidance of marine infrastructure is expected to be limited (and highly localised) and is unlikely to change the overall distribution of waterbird assemblages more widely on the foreshore in the local area. On this basis, while the probability of some localised effects is likely to be high, the magnitude and consequent exposure to change will be low. The sensitivity of coastal waterbirds to direct changes to foraging and roosting habitat on the scale predicted is likely to be moderate and thus vulnerability will be low. Importance is high because of the protection afforded to coastal waterbirds. Consequently, the overall impact is assessed as **minor adverse**.

Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats

General scientific context

10.8.66 Operational ports, wherever located, inevitably act as a potential source of disturbance in the coastal environment. Waterbird monitoring work in the vicinity of port locations has generally recorded limited evidence of birds on nearby intertidal habitat being disturbed through regular land side port operations with birds often becoming habituated (such as the movement of vehicles, cranes and cargo containers) (Ref 10-76; Ref 10-51). For example, Ref 10-69 reported that most species of waterbird assemblages utilising estuarine habitats adjacent to major infrastructure (such as power stations, jetties, bridges, port facilities etc) appear to be tolerant and will both roost and forage within less than 50m of the working infrastructure. Waterbirds have also been recorded regularly feeding under large industrial jetties as well as roosting on jetties and harbour walls.

10.8.67 Disturbance events have also been recorded as part of the ongoing IOH monitoring in the Port area since winter 2005/06[18]. This includes any potential disturbance due to operational activities on various jetties (such as the IOT (which includes vehicle activity), Western Jetty, Eastern Jetty and Immingham Bulk Terminal). During the surveys the vast majority of the disturbance observed was caused due to either raptors (such as peregrine and sparrowhawk), recreational activities (angling or dog walking) or maintenance work on the seawall. Disturbance was also recorded on several occasions as a result of construction or maintenance work on several of the jetties. No disturbance, however, was recorded as a result of vessel movements or operational activity at or near the berths or jetties.

10.8.68 In general, human presence on the foreshore (e.g., walking) is considered to cause greater disturbance than vehicles (Ref 10-52; Ref 10-53; Ref 10-62). With specific respect to activity associated with commercial operations and works, observations from monitoring and other studies (including specifically on the Humber Estuary), suggests that disturbance responses are typically greater for personnel in the open, compared to when enclosed within a vehicle at the same distances (Ref 10-69). Waterbirds are also considered more likely to habituate to vehicle movements which occur in a more predictable manner and in a spatially limited area compared to more erratic activity (such as quad bikes on the foreshore) (Ref 10-77; Ref 10-78; Ref 10-69).

10.8.69 Disturbance events from powered vessels are typically recorded within 100m of the receptor with vessels approaching at faster speeds eliciting higher disturbance. Predictability and randomness are factors of vessel traffic which can cause variation in waterbird response. Literature suggests that large commercial vessels consistently using defined routes (such as ferries or cargo ships) elicit less of a disturbance response than recreational craft which are more unpredictable in terms of speed and course and thus their disturbance potential for birds may be enhanced (Ref 10-42; Ref 10-43; Ref 10-44; Ref 10-54).

[18] These surveys have been undertaken twice a month from October to March (see **Section 10.6** for further information on these surveys).

Monitoring of potential disturbance due to the movements of vessels berthing at pontoons associated with offshore windfarm Operation and Maintenance ("O&M") facilities in several port locations near to mudflats used by waterbirds recorded evidence of some mild and localised disturbance and avoidance although events were generally infrequent with larger disturbance events (causing bird to fly out of the area) only occurring more rarely. Consistent evidence of changes (reductions) in waterbird abundance in the local area which could be linked to the operational activities was not recorded (Ref 10-76; Ref 10-114).

Project impact assessment

10.8.70 Operational disturbance stimuli could occur as a result of vessel movements associated with the Project. However, the berth during spring tide periods will be located approximately 1km from intertidal mudflat used by coastal waterbirds. On this basis, disturbance responses are considered highly unlikely due to vessel movements and berthing operations.

10.8.71 Disturbance could potentially occur as a result of vehicles on the approach jetty near the intertidal. The movement of vehicles will typically be restricted to periods when a vessel is berthed (i.e. 1-2 hours before vessel arrival to 1-2 hours after vessel departure) with typically up to ten vehicle return trips per day anticipated. A maximum of approximately 292 vessel callings per annum is expected to occur during operation. The majority of vehicle movements will be utility vehicles involved in transferring operations personnel, mooring line crew and vessel crew. This will include movement along the approach jetty which will be located above the intertidal mudflats. In general, human presence on the foreshore (e.g. walking) is considered to cause greater disturbance than vehicles (Ref 10-52; Ref 10-53; Ref 10-62). With specific respect to activity associated with commercial operations and works, observations from monitoring and other studies (including specifically on the Humber Estuary), suggests that disturbance responses are typically greater for personnel in the open, compared to when enclosed within a vehicle at the same distances (Ref 10-69). Waterbirds are also considered more likely to habituate to vehicle movements which occur in a more predictable manner and in a spatially limited area compared to more erratic activity (such as quad bikes on the foreshore) (Ref 10-77; Ref 10-78; Ref 10-69).

10.8.72 Vehicle movement will be undertaken at slow speeds (typically <12 miles per hour) and also in a predictable and consistent manner (i.e. producing the same type of visual/noise stimuli each time). Based on the evidence reviewed above, these are all attributes which support habituation and therefore are likely to limit disturbance responses. It should also be noted that many of the existing approach jetties in the Port have some vehicular access. The IOT approach jetty in particular has regular vehicle movements with no disturbance associated with this activity recorded during the IOH bird surveys (**Section 10.8**). Furthermore, pipe racks on one side of the approach jetty (which are no greater than 3m in height) will likely obscure the visibility that birds on the foreshore have to moving vehicles on the approach jetty and act as screens to some extent.

10.8.73 Regarding engineering and maintenance works, this activity is expected to be limited and only required occasionally.

10.8.74 The level of response that waterbirds will have to operations will be dependent to some extent on the sensitivity they have to anthropogenic disturbance stimuli. For example, species such as Turnstone and Dunlin are typically more tolerant than Shelduck and Curlew. The evidence presented above, however, suggests that birds are typically less affected by defined regular movements of people or vehicles near the shoreline (as occurs in port environments) than by random movements of people on the foreshore. Birds are regularly recorded feeding nearby or below port structures such as jetties or pontoons and appear to be relatively tolerant to normal day-to-day port operational activities.

10.8.75 It is acknowledged, however, that disturbance can occur as result of any human activity irrespective of habituation, if the activity occurs in sufficiently close proximity to a species so as to trigger a responsive reaction. Given that vessel movements will be occurring close to the foreshore on the approach jetty, intermittent disturbance responses are, therefore, still possible. This may particularly be the case at first when birds are likely to be less habituated to the new activity or as a response to a more infrequent sporadic type of activity on a structure with which birds are less familiar (such as maintenance works which are likely to be highly infrequent). Responses for most species are expected typically to involve infrequent, mild behavioural responses in a localised area in the vicinity of the approach jetty. The responses observed in birds are likely to range from increased vigilance to short flights with birds rapidly resettling and resuming feeding near their original location.

10.8.76 Based on the above, the probability of some mild and infrequent disturbance occurring is considered possible which could cause some limited (localised and temporary) displacement of coastal waterbirds around berthing infrastructure. It is expected, however, that birds will become habituated relatively quickly which will limit any longer-term disturbance responses. Furthermore, the foreshore in the vicinity of the approach jetty is used by relatively low numbers of waterbirds. The magnitude and consequently exposure to change is, therefore, likely to be low. The sensitivity of coastal waterbirds in the area is considered to range from low to moderate depending on the species. This is because even species considered relatively sensitive to disturbance appear to show relatively limited responses to operational stimuli. Importance is high because of the protection afforded to coastal waterbirds. As a consequence, the impact of disturbance during operation has been assessed as **minor adverse**.

10.9 Mitigation and Enhancement Measures

Disturbance to coastal waterbirds during construction

10.9.1 In order to reduce the level of impact associated with noise and visual disturbance during construction (which was assessed on a worst case basis, as minor to moderate adverse), the following mitigation measures will be implemented during construction.

Winter marine construction restriction from 1 October to 31 March (approach jetty)

10.9.2 In order to minimise potential disturbance effects on wintering populations of coastal waterbirds on the foreshore it is proposed that marine construction activity associated with the approach jetty can only be undertaken at distances greater than 200m of exposed intertidal foreshore during the period 1 October to 31 March inclusive. This restriction applies until an acoustic barrier/visual screen has been installed on both sides of the semi-completed structure. Construction activity can then be undertaken on the approach jetty itself, behind the screens, . The barrier/visual screen will only be required for the period 1 October to 31 March and for sections of the approach jetty within 200m of exposed intertidal foreshore. With the addition of acoustic barriers, noise levels on the intertidal mudflat will be less than 70 dB(A) which is the range of existing background noise levels of operational port activities in the Port area.

Noise suppression system (approach jetty)

It is proposed that a noise suppression system (consisting of a piling sleeve with noise insulating properties) is used during all percussive piling activities associated with the approach jetty (during all periods of the year) to reduce noise levels on nearby foreshore areas. The noise suppression system is predicted to reduce noise levels to <70 dB *Lmax* at distances greater than approximately 200m from the marine piling and also in the range of existing background noise levels of operational port activities in the Port area.

Soft starts

10.9.3 Using soft starts (as outlined in **Chapter 9: Nature Conservation (Marine Ecology [TR030008/APP/6.2]**) will allow birds to become more tolerant to marine piling noise by allowing a more gradual increase in noise levels which will reduce the potential for birds to become startled. This will be applied to all marine piling activity.

Cold weather construction restriction

10.9.4 Coastal waterbirds are considered particularly vulnerable to bird disturbance during periods of extreme winter weather. On this basis, it is proposed that a temporary cessation of all construction activity within 200m of exposed intertidal foreshore is implemented following seven consecutive days of freezing (zero or sub-zero temperature) weather conditions. The restriction should not be lifted until after 24 hours of above freezing temperatures and also that Metrological Office weather forecasts indicate that freezing conditions will not return for the next five days. Similar measures have been implemented for other nearby developments and also as part of the JNCC scheme to reduce disturbance to waterfowl due to shooting activity during severe winter weather.

10.9.5 Taking into account the mitigation measures described above, the residual effects for noise and visual disturbance during construction on coastal waterbirds are assessed as **minor adverse** and **not significant**.

Loss of breeding bird habitat within Long Strip woodland (construction)

10.9.6 As set out in **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]**, a compensation strategy for the loss of woodland (a UK Priority Habitat) will to be agreed with the local planning authority to ensure compliance with Local Planning Policy 41, which states that the council will seek to "..*minimise the loss of biodiversity features, or where loss is unavoidable and justified ensure appropriate mitigation and compensation measures are provided..".* An **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** has been prepared. A woodland compensation plan would be developed in accordance with the Strategy (and is secured by a Requirement of the **draft DCO).**

10.10 Assessment of Residual Effects

Construction

10.10.1 The following sections summarise the likely effects on ornithology receptors. Potential effects on the following receptors during construction were assessed as significant:

a. Noise and visual disturbance on intertidal feeding and roosting during construction.

b. Loss of woodland supporting breeding non-SPA/Ramsar birds.

10.10.2 Specific mitigation measures are proposed with respect to noise and visual disturbance to coastal waterbirds during construction.

10.10.3 Without mitigation, potential effects due to disturbance were assessed as **minor to moderate adverse**. The residual effects on these receptors are assessed as **minor** and not significant following the implementation of the proposed mitigation measures.

10.10.4 The permanent loss of woodland of the age and structure of Long Strip providing habitat for nesting birds can only be compensated over the medium to long term. Compensatory woodland planting will be delivered by the **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** and as described in **Section 10.9**. However, even with this compensation in place, given the time taken for the woodland to become established, the loss of breeding bird habitat is considered to be permanent for the purposes of this assessment. It is therefore assessed that the residual effect remains moderate adverse (**significant**).

10.10.5 All the other potential impacts on ornithology receptors have been assessed as **not significant**.

Operation

10.10.6 All potential impacts on ornithology receptors during operation have been assessed as **not significant**.

Decommissioning

10.10.7 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and the jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on ornithology receptors (terrestrial and marine) from decommissioning have been scoped out.

10.11 Summary of Assessment

10.11.1 A summary of the impact pathways that have been assessed, together with the identified residual impacts and level of confidence is presented in **Table 10-21**.

Table 10-21: Summary of potential impact, mitigation measures and residual adverse effects

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Coastal waterbirds	Direct loss to intertidal feeding and roosting habitat as a result of the piles	Insignificant	N/A	Insignificant	**High:** Baseline conditions and potential impacts on ornithology receptors are well understood
	Indirect changes to intertidal foraging and roosting habitat as a result of changes to hydrodynamic and sedimentary processes	Insignificant	N/A	Insignificant	**Medium;** The assessment is based on site specific data, and conceptual understanding of the study area combined with physical processes modelling. The numerical model is fully calibrated, however, it is recognised that such models represent a number of complex parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved
	Airborne noise and visual disturbance to coastal	Minor to moderate	Winter marine construction restriction on approach jetty for works within 200m of	Minor	**High:** Good understanding of the potential effects of

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
	waterbirds using intertidal habitats		exposed foreshore (1 October to 31 March) Noise suppression system for marine marine piling Acoustic barrier/visual screen on approach jetty from 1 October to 31 March Apply soft start procedures during marine marine piling Cold weather construction restriction (all construction activity)		disturbance and effectiveness of proposed mitigation based on site specific data and evidence from background literature.
Breeding birds (non-SPA/ Ramsar)	Permanent loss of woodland habitat within Long Strip	Moderate adverse	Compensation for loss of woodland to be agreed; like-for-like replacement would take longer to establish than the lifetime of this Project (which is anticipated to be 25 years for the operation of the terrestrial elements of the Project).	Moderate adverse Significant	**Medium**: likely to be some displacement of nesting pairs to surrounding habitats rather than total loss of all nesting species.
Operational Phase					
Coastal waterbirds	Direct changes to foraging and roosting habitat as a result of the presence of infrastructure	Minor	N/A	Minor	**Medium:** Generally good understanding of the potential effects based on site specific data and evidence from background literature.

Receptor	Impact pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
	Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats	Minor	N/A	Minor	**High**: Good understanding of the potential effects of disturbance and effectiveness of proposed mitigation based on site specific data and evidence from background literature.

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 11: Traffic & Transport

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 11: Traffic & Transport

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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11 Traffic and Transport

11.1 Introduction

11.1.1 This chapter of the Environmental Statement ("ES") addresses the likely significant effects of the Project on traffic and transport receptors during construction in respect of landside traffic and transport effects. Marine transport and navigation effects are considered within **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**. The assessment considers the following:

a. The present day and future baseline conditions during construction.

b. The effects of construction traffic on the local road network including the strategic road network as a result of the Project in terms of the increase in overall vehicle numbers, including Heavy Goods Vehicles ("HGVs").

11.1.2 The operational phase is anticipated to employ 120 workers in total for the terminal and the hydrogen production facility, of which 53 will be onsite during the normal working day with a further 67 working shift patterns. There are also anticipated to be an average of around 96 two-way daily HGV movements (48 inbound and 48 outbound) associated with the operational hydrogen production facility. The operational impacts of the Project have therefore been scoped out of the traffic and transport assessment given the low volumes of traffic generated and that significant effects are unlikely to arise.

11.1.3 The decommissioning effects of landside traffic and transport are also scoped out of the Environmental Impact Assessment ("EIA") based on an agreement on this through the Scoping Opinion (see **Table 11-1**) and given the commitment to deliver a Decommissioning Environmental Management Plan ("DEMP") which will be secured through a requirement of the draft Development Consent Order ("DCO").

11.1.4 The interrelationships between the potential effects of the Project on traffic and transport and other disciplines are addressed in the following chapters **[TR030008/APP/6.2]**:

a. Chapter 6: Air Quality

b. Chapter 7: Noise and Vibration

11.1.5 This chapter is supported by the following figures **[TR030008/APP/6.3]** and appendices **[TR030008/APP6.4]**:

a. **Figure 11.1: Study Location**

b. **Figure 11.2: Local Highway Network**

c. **Figure 11.3: Public Right of Way ("PRoW") Network**

d. **Figure 11.4: Collision Locations**

e. **Appendix 11.A: Traffic Collision Data**

f. **Appendix 11.B: Traffic and Transport Cumulative Effects Assessment**

11.2 Consultation and Engagement

11.2.1 An EIA scoping exercise was undertaken in August 2022 to establish the form and nature of the traffic and transport assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on traffic and transport. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 (**Appendix 1.B [TR030008/APP/6.4]**).

11.2.2 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the *Planning Act 2008* ("2008 Act). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

11.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to inform the consultation. The PEI Report Addendum provides updated details of the HGV movements associated with the construction of the Project as well as the proposed reduction to 30mph to the speed limit on Laporte Road.

11.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement, is summarised in **Table 11-1**.

Table 11-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	Response
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes that no assessment of the decommissioning aspect of the Proposed Development be undertaken because the number of vehicles and the future baseline cannot be predicted at this time, and any assessment would not be accurate. Subject to the provision of the Outline Decommissioning Plan secured within the DCO, the Inspectorate agrees to scope out this matter from the ES.	Noted. The draft DCO includes a requirement to provide a Decommissioning Environmental Management Plan in accordance with an **Outline DEMP [TR030008/APP/6.6]**.
	Planning Inspectorate	The ES should provide robust justification for the study area, supported with figures where necessary to show the extent of the affected road network ("ARN") considered and any agreement regarding the approach with relevant consultation bodies.	Noted. The study area is set out within **Section 11.5** and shows the Affected Road Network. It was discussed and agreed with North East Lincolnshire Council ("NELC") (during a meeting on 2 February 2023). Through consideration of the responses to Statutory Consultations, the developing environmental assessments and through ongoing design development, the design of the Project has evolved and a number of refinements and modifications have been made. There have therefore been small changes to the Site Boundary.
	Planning Inspectorate	The Automated Traffic Counts ("ATCs") and Manual Classified Counts ("MCCs") surveys should be clearly explained and justified as part of the methodology used to determine likely effects. The proposed ATC/ MCC locations should be included	Noted. The details of the baseline traffic data are included within **Section 11.6**, with the extent of the study area having been agreed

Reference/Date	Consultee	Summary of Response	Response
		in the ES, supported by figures which clearly identify these and the locations should be agreed on with the relevant consultation bodies, where possible.	in the NELC response to the EIA Scoping Report.
Scoping Report August 2022	Royal Mail	Every day in exercising its statutory duties Royal Mail vehicles use all of the main roads that may potentially be affected by the proposed Immingham Green Terminal ("IGT"). Any periods of road disruption/closure, night or day, on or to the roads immediately connected to the IGT or the surrounding highway network will have the potential to impact operations and may consequently disrupt Royal Mail's ability to meet its Universal Obligation service delivery targets.	The routeing of construction vehicles will be managed through the implementation of the **Outline Construction Traffic Management Plan** ("OCTMP") **[TR030008/APP/6.7]** and which is to be secured by DCO Requirement with the Final CTMP being agreed with the NELC prior to construction commencing on site. There would be some localised highway works to Kings Road, Queens Road and Laporte Road associated with culvert works, utilities connections and protective works and the creation of site entrances. These works would be undertaken using powers included within the draft DCO. Liaison would be undertaken with NELC for all works in the highway. Any road closures (for example for the construction of **Work No. 4** on Laporte Road) would be managed and agreed with the Local Highway Authority, with suitable diversion routes being available, e.g. via Kiln

Reference/Date	Consultee	Summary of Response	Response
			Lane. No significant disruption is expected. All construction traffic would be routed via the Strategic Road Network with no construction traffic routed through the town of Immingham. No adverse traffic effects are expected on the town of Immingham.
Scoping Report August 2022	North East Lincolnshire Council (Highways)	Content with the scope of the traffic and transport assessment.	No response required.
Scoping Report August 2022	East Lindsey District Council	No comments on the Scoping Report.	No response required.
PEI Report January 2023	Anglian Water	The traffic and transport chapter should include the impacts of HGV and plant during construction and operation on buried utilities including Anglian water's pipelines. Alternatively, this could be included in Chapter 22: Major Accidents and Disasters or Chapter 23: Socio-Economics or Chapter 24: Human Health to ensure that consideration is given to impacts on residents and business from distribution of water and water recycling services caused by an increased frequency of traffic movements on buried infrastructure. Water supply network assets for example run along Kings Road, Queens Road and the southern boundary of the site.	No damage to Anglian Water infrastructure (or indeed any buried utilities) is predicted. Anglian Water infrastructure (primarily pipelines) is generally buried in the highway and will not be damaged by traffic movements and are not covered in this chapter. The **Utilities Statement [TR030008/APP/7.7]** provides a summary of the approaches taken to utility connections, diversions and protections, including to Anglian Water assets. Table 4-3 and Table 4-4 in the **Utilities**

Reference/Date	Consultee	Summary of Response	Response
			Statement [TR030008/APP/7.7] specifically cover the Anglian Water Assets that have been identified and require protection. The exact details of the protection are to be agreed with Anglian Water. Protective Provisions in favour of Anglian Water, which include the protection of existing assets, are proposed within the **draft DCO [TR030008/APP/2.1]**.
PEI Report January 2023	Network Rail	In respect of the works adjacent to the operational railway boundary including the compound, we will be keen to ensure that there are sufficient boundary treatments in place (appropriate fencing and Armco barriers) to prevent trespass and vehicle incursion onto the operational railway line. The routing of construction traffic (including HGVs/abnormal loads) and subsequent operational site traffic will require further consideration and discussion with Network Rail ("NR") if such routes take in railway assets, such as bridges (with low clearance/weight restrictions) and railway level crossings. At this stage the information supplied is not sufficiently detailed to fully assess potential impacts of the scheme on the railway. In order to ensure that the scheme does not impact on operational railway safety, the developer must liaise closely with Network Rail Asset Protection to ensure that the haulage routes into the site are appropriate, and the design and construction of the new facility and associated infrastructure will not have an adverse impact on railway operations. It is therefore assumed that a condition of the Order would be that	The Project's main interaction with railway infrastructure is the bridge on Queens Road over the railway line, which is not signed as having any traffic or weight restrictions. It is currently assumed that the primary routing for construction HGV traffic is to be via the A1173 to the Temporary Construction Area on Laporte Road (**Work No. 9**), so avoiding the railway bridge. An **OCTMP [TR030008/APP/6.7]** accompanies the application and the final version is to be secured by DCO Requirement. The OCTMP sets out measures to control construction traffic from the commencement of construction with a final detailed CTMP will be

Reference/Date	Consultee	Summary of Response	Response
		detailed specifications of the proposed scheme and traffic management plans are to be provided and agreed in writing before development can commence.	produced prior to the commencement of construction and will be prepared in accordance with the **OCTMP [TR030008/APP/6.7]**. With regards boundary treatments, the Final CTMP will assess and identify if any additional barrier protection is required at the Queens Road railway bridge to minimise risk of vehicle incursion onto the railway. During the construction phase, NR will be fully consulted by the contractor to ensure that all works comply with any relevant guidance regarding working in close proximity to a live railway, and any measures put in place will be kept to the required standard for the full duration of the works.
PEI Report January 2023	West Lindsey District Council	West Lindsey District Council in principle supports renewable energy development and the reduction of the local and national carbon footprint. The western edge of the Terminal would be approx. Three miles to the east of the nearest West Lindsey District boundary. Given the distances, it is unlikely that the development would have any significant material impact on West Lindsey or its residents. The primary consideration would be the impact of the construction, operation and decommissioning phases on the local highway network if traffic was to be directed through parts of West Lindsey. Chapter 11	No HGV traffic is proposed to be routed through West Lindsey District, with the majority of workers (80%) assumed to be distributed within North East Lincolnshire. The traffic generation and distribution is set out within **Section 11.7**.

Reference/Date	Consultee	Summary of Response	Response
		of the PEI Report does not mention West Lindsey or any of its main highway routes. West Lindsey would request that its highway network is considered in any future traffic and transport assessments even if this is to clarify that its highway network would not be utilised. It would be recommended that the Highways Authority at Lincolnshire County Council is consulted for comment.	The main traffic impact would be within North East Lincolnshire, with HGVs using the strategic road network ("SRN") (M180) and then the A1173. It is assumed that both construction and operational workers would primarily reside in Immingham and Grimsby.
PEI Report January 2023	North East Lincolnshire Council	The proposed project will attract a reasonable number of associated vehicle movements in relation to the development but it is likely that the most significant impact of the development will come through the construction phase. Various meetings have taken place with the applicants, North East Lincs Highways Authority to look at such impacts and the management of the construction phase. The Highway Authority look forward to the full and final Transport Assessment being submitted and will continue to work with the applicants to resolve any highway concerns throughout the process.	This chapter considers the impact of the Project, and an assessment of the vehicle movements associated with the construction phase is presented within **Section 11.9**. A separate Transport Assessment has not been prepared as the full details of trip generation and distribution for both the construction and operational phases are included within **Section 11.7**. The operational phase is only expected to generate 96 two-way HGV movements per day (48 arrivals and 48 departures) with a total of 120 staff anticipated to be employed, of which 67 would work on a shift pattern and 53 would travel in the "normal" weekday AM and PM peak periods. This chapter includes an assessment of the

Reference/Date	Consultee	Summary of Response	Response
			construction traffic associated with the Project on the local road network to assess the transport impact during this phase.
PEI Report January 2023	Polynt Composites	We have significant concerns around the traffic and transport impacts of the IGET Project during both the construction and operational phases of the scheme. The data on these impacts that accompanies the consultation information identifies significant increases in vehicle movements on the surrounding highway network, particularly on Kings Road and Queens Road and the junction of the latter with Laporte Road. This is already a very busy route during rush hour, with queueing traffic waiting to access the docks from Queens Road and Laporte Road. Laporte Road is the only access to our Plant, with traffic (and our employees) approaching via Queens Road or Kiln Lane/Hobson Way. A significant increase in traffic here will cause excessive congestion and queues that would impact on our Laporte Road access, causing issues for employees and deliveries in and out of site. To confirm, 34,000 tonnes of raw materials and finished products arrive, or leave the site per annum by road. Increased traffic will comprise a considerable number of HGV movements. As noted, Laporte Road is a very busy highway being the main access point to the docks at its junction with Queens Road. The proposed access point to the temporary construction compound is c. 200 yards from the entrance to our Plant. We have many HGVs making deliveries to the Plant daily. With no middle right hand turning lane, and limited space at the entrance to our Plant, there are already occasions when the traffic has needed to queue to access the site, leading to a number of near misses in the past with HGV's waiting to gain	The impact of the traffic during both the construction and operational phases is set out in this chapter. A number of HGVs would need to access the Temporary Construction Area (**Work No. 9**) at the northern end of Laporte Road but would then be routed along Queens Road and Kings Road to use the A1173 to access the wider highway network via the A180. In terms of construction workers and employees, only those residing within Grimsby are forecast to use Laporte Road. Through the adoption of a final detailed **Construction Traffic Management Plan** ("CTMP") based on the **OCTMP [TR030008/APP/6.7]**, the chosen contractor would be required to liaise closely with all local businesses to inform them of any peaks in activity so that this can be managed.

Reference/Date	Consultee	Summary of Response	Response
		entry. Increased traffic flow during construction phase of the IGET Project has the potential to exacerbate this problem and it is not unforeseeable that the queues from the junction (Laporte and Queens Road) during rush hour could back up to the Plant entrance, restricting access for deliveries, employees and visitors. It is unclear whether any investigation of the potential to use the port to deliver construction materials etc. necessary to deliver the scheme has been explored as an alternative measure to reduce vehicle movements on the local highway network.	The construction compound access points and all site entrances have been designed to ensure adequate separation from existing junctions and appropriate sight lines, so that any queueing on the road network is minimised and avoided wherever possible. There would be some localised highway works to Kings Road, Queens Road and Laporte Road associated with culvert works, utilities connections and protective works and the creation of site entrances. These works would be undertaken using powers included within the draft DCO. Liaison would be undertaken with NELC for all works in the highway. Any road closures (for example for the construction of **Work No. 4** on Laporte Road) would be managed and agreed with the Local Highway Authority, with suitable diversion routes being available, e.g. via Kiln Lane. No significant disruption is expected. It is anticipated that much of the construction materials and components associated with the construction of the marine works would be delivered by sea to the

Reference/Date	Consultee	Summary of Response	Response
			Port of Immingham, and then taken to site using the A1173 Kings Road. This is also likely to be the case for large, prefabricated elements and large operational plant associated with the hydrogen production facility.
PEI Report January 2023	Royal Mail	Royal Mail has operational properties within 12 miles of the proposed works: · BE 2701, Immingham DO – c. 1.1 miles north-west; · BE 2834, Grimsby DO – c. 5 miles south-east; · BE2708, Grimsby RTW – c. 5 miles south-east; · BE 2713, Barton upon Humber DO- c. 11.5 miles north-west; and BE 3211, Barton Antelope Road PAR- c. 11.5 miles north-west The PEIR sets out that the following roads on the highway network may be used and therefore potentially affected by the proposed scheme: • A1173; • A160; • A180; • M180; and • Local roads. The PEIR states “the main approach to mitigating potential traffic impacts would be the use of management measures to reduce as far as is possible the number of vehicle trips on the local highway network”. Royal Mail notes a Construction Traffic Management Plan (“CTMP”) and a Construction Worker Travel Plan (“CWTP”) will be prepared and submitted as part of the	Through the adoption of a final detailed **CTMP** based on the **OCTMP [TR030008/APP/6.7]**, the chosen contractor would be required to liaise closely with all local businesses to inform them of any peaks in activity so that this can be managed. The construction compound access points and all site entrances have been designed to ensure adequate separation from existing junctions and appropriate sight lines, so that any queueing on the road network is minimised and avoided wherever possible. There would be some localised highway works to Kings Road, Queens Road and Laporte Road associated with culvert works, utilities connections and protective works and the creation of site entrances.

Reference/Date	Consultee	Summary of Response	Response
		DCO application, and prior to the construction phase of the scheme. The PEIR NTS states the CTMP would be prepared to "control Heavy Goods Vehicle Movements" and the CWTP "to control the trips made by construction workers (including encouraging car sharing) and thus reduce the impact of the workforce upon the highway network." Specifically, these Plans would "set out measures and controls to limit the number of trips on the network in peak hours, and as such would aim to limit the traffic impact of the construction phase as far as possible". Every day, in exercising its statutory duties Royal Mail vehicles use all of the main roads that may potentially be affected by the proposed IGET. Any periods of road disruption / closure, night or day, on or to the roads immediately connected to the IGET or the surrounding highway network will have the potential to impact operations and may consequently disrupt Royal Mail's ability to meet its Universal Obligation service delivery targets. These obligations are in the public interest and should not be affected detrimentally by any statutorily authorised project. Accordingly, Royal Mail seeks to take all reasonable steps to protect its assets and operational interests from any potentially adverse impacts of the proposed development. In order to protect Royal Mail's position, it is requested that wording is added to the future Construction Transport Management Plan (CTMP) to secure the following mitigations: The CTMP includes specific requirements that during the construction phase, Royal Mail is notified by Associated British Ports or its contractors at least one month in advance on any proposed road closures/diversions/alternative access arrangements, hours of working;	These works would be undertaken using powers included within the draft DCO. Liaison would be undertaken with NELC for all works in the highway. NELC would be fully consulted in regard to any temporary road closures (for example for the construction of **Work No. 4** on Laporte Road) The **OCTMP [TR030008/APP/6.7]** includes a requirement for the contractor to provide at least one months notice to all local businesses regarding any works that would affect the local road network such as road works or road closures.

Reference/Date	Consultee	Summary of Response	Response
		Where road closures/diversions are proposed, Associated British Ports or its contractors liaise with Royal Mail at least one month in advance to identify and make available alternative highway routes for operational use, where possible; and The CTMP includes a mechanism that informs Royal Mail about works affecting the local highways network (with particular regard to Royal Mail's distribution facilities near the proposed works, as identified above)	
PEI Report January 2023	Local Resident (living within approx. 10km of the Project)	HGVs in Immingham are a large problem. The local road; Kings Road through to Queens Road and the dock road are in a bad state of repair, so an increased load of traffic will only compound this issue. I believe that something should be done regarding HGVs and using this route.	A road condition survey will be undertaken to determine the existing condition of the road prior to the start of construction works. If the condition is altered due to the works, appropriate measures would be put in place to remediate any defects. The details of this would be included within the detailed **CTMP** based on the **OCTMP [TR030008/APP/6.7]**.
PEI Report January 2023	Local Resident (living within approx. 10km of the Project)	Proposed tanker entrance onto busy A1173 – why not the quieter Queens Road?	The approach to site accesses has been determined by both the construction requirements and the proposed layout of the Project. New junctions have all been designed to the required standard to ensure safe operation and would be agreed with the Local Highway Authority.

Reference/Date	Consultee	Summary of Response	Response
PEI Report January 2023	Local Resident (living within approx. 10km of the Project)	Concern for the use of the roads during construction.	**Table 11-25** provides an assessment of the impact of vehicle movements during construction, and it concluded that the effects on the road network would not be significant based on 70% of HGVs travelling to the West Site only..
PEI Report January 2023	DFDS Seaways	The hydrogen produced as outlined in the IGET is going to be taken away from the facility by road tanker which will create a cumulative effect along with the traffic issues of the IERRT and other IGET traffic (e.g. during construction). 2,200 additional HGVs are expected to use the East Gate for IERRT. We have expressed our concerns that the mitigation measures for the IERRT are insufficient, and we disagree with the statement in the IGET PEIR that these mitigation effects will reduce effects on a transport network to a level which is not significant; instead it will have unacceptable impacts on port users as well as local residents and businesses. Another 195 HGV movements a day during construction and 98 HGV movements a day during operation of the IGET will exacerbate this further and no additional mitigation has been proposed.	An assessment of the cumulative impact has been undertaken within **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** and the environmental effects as they relate to traffic and transport are not significant.
Second Statutory Consultation May 2023 – July 2023	West Lindsey District Council	The western edge of the Terminal would be approximately 3 miles to the east of the nearest West Lindsey District boundary. Given the distances it is unlikely that the development would have any significant material impact on West Lindsey or its residents. West Lindsey's primary consideration would be the impact of the construction, operation and decommissioning phases on the local highway network if traffic was to be directed through	No HGV traffic is proposed to be routed through West Lindsey District, with the majority of workers (80%) assumed to be distributed within North East Lincolnshire. The traffic generation and distribution is set out within **Section 11.7**.

Reference/Date	Consultee	Summary of Response	Response
		parts of West Lindsey. West Lindsey would request that its highway network is considered in any future traffic and transport assessments even if this is to clarify that its highway network would not be utilised. It would be recommended that the Highways Authority at Lincolnshire County Council is consulted for comment.	The main traffic impact would be within North East Lincolnshire, with HGVs using the SRN (M180) and then the A1173. It is assumed that both construction and operational workers would primarily reside in Immingham and Grimsby.
	National Highways	This review has considered a Preliminary Environmental Information Report (PEIR) which was originally published in January 2023, and the PEIR Addendum, submitted by Associated British Ports in relation to the construction of a multi-user liquid bulk jetty named the Immingham Green Energy Terminal. The request is made pursuant to Regulation 13 of the Infrastructure Planning (Environmental Impact Assessment) Regulation 2017. A summary of our comments is set out below: The forthcoming DCO application should be accompanied by a TA; The traffic generation associated with both the Construction and Operational Phase be fully and robustly set out in the TA; The Applicant will need to provide an hourly break-down of the traffic to be generated and depending on the number of vehicular trips during the AM and PM peak-hours, trip distribution and assignment graphs might also need to be submitted for review; With regards to the operation of the SRN, it is important that the potential impact of the development be established at the	A TA has not been prepared as set out in ES. The traffic generation associated with the construction and operational phase is set out is **Table 11-10** and **Table 11-22** respectively, with an hourly breakdown of the construction traffic shown in **Table 11-13** and **Table 11-14**. The distribution of construction traffic shown in **Table 11-16** and **Table 11-18** respectively, with the operational impact upon the strategic road network shown in **Table 11-23**. Circular 01/2022 – The Strategic Road Network and The Delivery of Sustainable Development; and - National Highways' guidance document 'The Strategic Road Network: Planning for The Future

Reference/Date	Consultee	Summary of Response	Response
		A180 / A1173 junction, and elsewhere on the SRN where traffic generation is considered to result in the material impact; The Applicant should consider the following documentation and guidance when preparing the TA: - Circular 01/2022 – The Strategic Road Network and The Delivery of Sustainable Development; and - National Highways' guidance document 'The Strategic Road Network: Planning for The Future.'; The TA should include a collision data analysis covering the most recently available complete five-year period for the SRN, including the A180 / A1173 junction and elsewhere on the SRN where traffic generation is considered to result in the material impact; however it is not acceptable to use 2020 and 2021 data for the analysis because the traffic flows during these years were materially influenced by the Covid-19 pandemic; In terms of assessing the cumulative effects, the following development should also be considered alongside the current Immingham Green Energy Terminal application, within the ES and requested TA: Station Road South Killingholme, works on land to the east of Rosper Road, Killingholme (planning reference: PA/SCO/2022/7); National Highways supports and requires the preparation and implementation of Travel Plans to limit the volume of private vehicle trips to and from developments and to promote sustainable modes of travel; A CTMP should be prepared and be a condition of a planning consent. It will need to be submitted and approved in writing by National Highways prior to the commencement of construction. The CTMP will need to include at least: a dust management plan	and been considered within **Table 11-2.** **Section 11.6** includes a review of the relevant collision data between 2017 and 2022, and whist the data from 2020 and 2021 may not be necessarily reflective of "normal" operating conditions, the use of data prior to 2017 is not considered to be necessarily relevant as it would at least 6 years old and may not then reflect current operating conditions. The cumulative effects have been included within **Chapter 25: Cumulative Effects and In-Combination Assessment**. An **OCTMP** and **Outline Construction Worker Travel Plan** ("OCWTP") **[TR030008/APP/6.7]** have been prepared and they include the items listed, with the dust, noise and pollution controls being covered in the **Outline Construction Environmental Management Plan [TR030008/APP/6.5]**.

Reference/Date	Consultee	Summary of Response	Response
		a noise management plan pollution prevention measures staffing numbers contractor parking construction traffic routes details of delivery arrangements (including for any abnormal loads) measures to limit and manage transfer of debris on to the highway	
	DFDS Seaways	**Traffic and Transport** Traffic and Transport The hydrogen produced as outlined in the IGET is going to be taken away from the facility by road tanker which will create a cumulative effect along with the traffic issues of the IERRT and other IGET traffic (e.g. during construction). 2,200 additional HGVs per day are expected to use the East Gate for IERRT. We have expressed our concerns that the mitigation measures for the IERRT are insufficient, and we disagree with the statement in the IGET PEIR that these mitigation effects will reduce effects on a transport network to a level which is not significant; instead it will have unacceptable impacts on port users as well as local residents and businesses. One of the changes made by ABP to the IGET proposal in this consultation is to revise upwards the number of HGV movements from 195 HGV movements a day during construction to 260 movements per day at the peak of construction and remain at 98 HGV movements a day during	The number of construction HGVs as set out in **Table 11-10** is 196 per day two way, which with reference to **Table 11-14** is around 19 per hour two way (ten arrivals and nine departures). This is then one additional HGV every three minutes on average, which is not considered to be severe, and is in any case only a temporary impact. During the operational phase there will be around 96 HGVs per day which, with reference **Paragraph 11.8.11**, equates to four per hour two way (two arrivals and two departures), which is around one HGV every 15 minutes, which is not considered to be severe.

Reference/Date	Consultee	Summary of Response	Response
		operation of the IGET. We were previously concerned that the 194 HGV movements a day had not been considered fully. No doubt this increase to 260 HGV movements a day will further exacerbate the traffic and all its unwelcome impacts, without any additional mitigation being proposed. Our argument that the impacts of these additional HGV movement during construction have not been assessed properly are bolstered by Table 7.2 – Preliminary Environmental Information: Implications of the Proposed Changes by Topic of the PEIR Addendum. The column for "Re-assessment of significant effects" says the following in relation to the topics of Air Quality, Noise and Vibration and Nature Conservation (Terrestrial Ecology) as a resulted of the increase in HGV movements: The summary reported in the PEI Report is unchanged. However the residual effects will be confirmed after reassessment within the ES This shows that adequate assessment, especially when considered cumulatively with the IERRT, has not yet been carried out. The PEIR addendum considered the IERRT in relation to Changes No 2 and 3 but does not consider the cumulative effect of the IERRT in relation to Change number 5: Construction Vehicle Numbers and still fails to consider cumulative effects in relation other safety issues such as increased marine traffic near the IOT trunkway or reduced tug availability.	The Air Quality, Noise and Vibration and Nature Conservation (Terrestrial Ecology) impacts are set out with **Chapter 6: Air Quality, Chapter 7: Noise and Vibration and Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]** respectively, with a cumulative assessment of the traffic and transport impact being included within **Chapter 25: Cumulative and In-Combination Effects**. The above construction impact has been assessed as it relates to traffic and transport within this chapter and is set out in **Table 11-25** with the impacts being considered either negligible or minor and therefore not significant.
	Royal Mail	It is noted that the revised DCO boundary as shown in the Second Statutory consultation plan ref GH-2015660 includes	The works to the A1173 Kings Road are in relation to allowing Abnormal Loads to access the

Reference/Date	Consultee	Summary of Response	Response
		four sections of the A1173 Kings Road, presumably for road works to improve traffic capacity. It is emphasised that Immingham Delivery Office (location shown with a red arrow above) takes access from the A1173 via Middleplatt Road and thus any disruption to this route during works may impact on Royal Mail's operations to and from Immingham Delivery Office. Royal Mail does not wish to stop or delay the IGET works from occurring. However, Royal Mail does wish to ensure the protection of its future ability to provide an efficient mail sorting and delivering service to the public from and to the above identified operational facilities in accordance with its statutory obligations. In order to protect Royal Mail's position, it is requested that wording is added to the future Construction Transport Management Plan ("CTMP") to secure the following mitigations: 1. the CTMP includes specific requirements that during the construction phase Royal Mail is notified by Associated British Ports or its contractors at least one month in advance on any proposed road closures / diversions / alternative access arrangements, hours of working; 2. where road closures / diversions are proposed, Associated British Ports or its contractors liaise with Royal Mail at least one month in advance to identify and make available alternative highway routes for operational use, where possible; and 3. the CTMP includes a mechanism that informs Royal Mail about works affecting the local highways network (with	project from Immingham Docks and relate to the removal of overhead lines and relatively minor amendments to street furniture, and therefore any disruption would be of a short duration. The CTMP already includes a section about consulting any affected third parties in relation to road works, with a one month period already being included, as set out in section 6 of the CTMP.

Reference/Date	Consultee	Summary of Response	Response
		particular regard to Royal Mail's distribution facilities near the proposed works, as identified above).	

11.3 Legislation, Policy and Guidance

11.3.1 **Table 11-2** presents the legislation, policy and guidance relevant to the traffic and transport assessment and details how they have been addressed within this assessment.

Table 11-2: Relevant Legislation, Policy and Guidance Regarding Traffic and Transport

Legislation/Policy/Guidance	Consideration within this chapter
Guidelines for the Environmental Assessment of Road Traffic 1993 ("GEART") (Ref 11-1)	
Sets out the assessment methodology for road traffic assessments. The main consideration being the two rule approach used to assess the extent of any assessment: • Rule 1 – include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%). • Rule 2 – include any other specific sensitive areas where traffic flows have increased by 10% or more.	The thresholds set out within the guidelines have been used as the basis for the traffic and transport impact assessment, as set out in **Section 11.8**.
National Policy Statement for Ports ("NPSfP") (2012) (Ref 11-3)	
The NPSfP is a framework to address proposals for port development in the UK and associated development (rail and road). This describes the UK Government's conclusions on new port infrastructure in the context of future demand, needs and the current economy. Paragraph 5.4.4 states that the assessment should distinguish between the construction, operation and decommissioning project stages as appropriate. Paragraph 5.4.5 states that, where appropriate, a travel plan, including demand management measures to mitigate transport impacts, should be prepared. Paragraph 5.4.8 states that transport assessment should include private traffic accessing and leaving the port, where significant, even where not generated by the development under application.	The NPSfP requirements have been considered within this traffic and transport assessment. The three project stages (construction, operation and decommissioning) defined have been considered and the extent of the study area has been scoped with NELC as explained in **Section 11.4**. An **OCTMP** and an **OCWTP [TR030008/APP/6.7]** have been prepared to mitigate the construction impact of both HGVs and construction workers respectively. The assessment includes baseline traffic collected in 2021 along with a full consideration of cumulative developments as set out in **Chapter 25: Cumulative Effects and In-Combination Assessment [TR030008/APP/6.2]** and presented in **Appendix 11.B [TR030008/APP/6.4]**.
National Planning Policy Framework ("NPPF") (2021) (**Ref 11-2)**	
NPPF paragraph 111 states: *"Development should only be prevented or refused on highways grounds if there would be an unacceptable impact on*	The NPPF requirements have been considered within this traffic and transport assessment, and

Legislation/Policy/Guidance	Consideration within this chapter
highway safety, or the residual cumulative impacts on the road network would be severe." This policy sets out the guidance in relation to the impact of developments and when they should be refused.	the impacts are considered to be either minor or negligible, and not significant (see **Table 11-26**)
Planning Practice Guidance – Travel Plans, Transport Assessments and Statements (2014) (**Ref 11-4)**	
This Planning Practice Guidance provides general guidelines for travel plans, transport assessments and statements.	The guidance has been taken into account when defining the traffic and transport assessment methodology applied, as well as the measures to be included within the **OCWTP [TR030008/APP/6.7]**.
Department for Transport ("DfT") Circular 01/2022: Strategic Road Network and the Delivery of Sustainable Development (2022) (Ref 11-5)	
Published in December 2022 by the DfT which sets out the way in which National Highways will engage with the development industry to deliver sustainable development and, thus, economic growth, whilst safeguarding the primary function and purpose of the strategic road network.	The guidance has been considered in terms of the impact upon the Strategic Road Network and the production of the **OCTMP** and **OCWTP [TR030008/APP/6.7]**, based upon previous experience of working with National Highways on similar type of project.
National Highways' guidance document 'The Strategic Road Network: Planning for The Future.;	
Published by Highways England (now National Highways) and aims to describe the approach taken by NH when engaging with the planning system and is written in the context of the statutory responsibilities and Government policy as set out in NPPF and DfT Circular 02/2022.	The guidance has been considered in the preparation of this chapter, with the traffic impact during both the construction and operational phases being set out within **Section 11.3** and mitigation through the production of the **OCTMP** and **OCWTP [TR030008/APP/6.7]**, based upon previous experience of working with National Highways on similar type of project.
Design Manual for Road and Bridges ("DMRB") CD 123 Geometric design of at-grade priority and signal-controlled junctions (Ref 11-6)	
Outlines the geometric parameters in relation to the design of new junctions.	These design standards have been taken into account in the design of new junction arrangements for the site entrances required by the Project.
North East Lincolnshire Local Plan 2013 to 2032 (adopted 2018) (**Ref 11-7**)	
Strategic Objective 7 considers transport around North East Lincolnshire which states "*Improve accessibility to jobs and services by sustainable transport modes, including cycling and walking; reduce the overall need to travel with employment and housing growth spatially balanced; and, provide*	To promote sustainability during the construction phase, an **OCTMP** and an **OCWTP [TR030008/APP/6.7]** have been prepared and are included in the DCO application.

Legislation/Policy/Guidance	Consideration within this chapter
necessary infrastructure to support sustainable growth." Policy 36 Promoting sustainable transport, states that the overall aim is "*To reduce congestion, improve environmental quality and encourage more active and healthy lifestyles, the Council will support measures that promote more sustainable transport choices*" "*Planning permission will be granted where any development that is expected to have significant transport implications delivers necessary and cost effective mitigation measures to ensure that development has an acceptable impact on the network's functioning and safety. These measures shall be secured through conditions and/or legal agreements.*"	

Limitations and Assumptions

11.3.2 The information presented in this assessment reflects that obtained and evaluated at the time of reporting and is based on the maximum extent of land required for construction and operation of the Project.

11.3.3 The baseline traffic data used for the assessment is based on secondary data from surveys undertaken on behalf of ABP as part of the Immingham Eastern Ro-Ro Terminal ("IERRT") proposed development, as well as Automated Traffic Counts ("ATCs") undertaken on Laporte Road in the week commencing 5 January 2023. The data used for the IERRT proposals was recorded by way of survey undertaken in 2021 and reported in the David Tucker Associates Preliminary Transport Assessment (Ref 11-9).

11.3.4 In relation to the HGV distribution, it is assumed that all construction vehicles would travel to and from the Site via the A1173 towards the A180 where they are distributed, based upon the pattern of movements that existing HGVs currently make. No HGV movements for the Project have been distributed through the residential areas of Immingham to the north to avoid travelling past the residential properties located on the A1173, with the A180 providing access to both Immingham and Grimsby Ports.

11.3.5 It has been assumed that the construction traffic is split between the west and east sites as follows:

a. Construction workers – 80% in the West Site and 20% in the East Site

b. Construction HGVs – 70% to the West Site and 30% to the East Site

11.3.6 As discussed in **Chapter 5: EIA Approach [TR030008/APP/6.2]**, a Rochdale Envelope approach is being used to ensure that the ES assesses the likely significant effects of the Project. The traffic and transport construction assessment has been based on the assumption of a peak of construction activity occurring in Month 23, which would be towards the end of 2026. The results

presented in this assessment are representative of earlier assessment years and the overall effect of the Project may be less than that presented, as background traffic is expected to increase year on year. It is considered that a worst-case scenario has been assessed in line with the Rochdale Envelope approach.

11.4 Assessment Methodology

Scope of Assessment

11.4.1 The assessment scenario considered in this chapter relates solely to the construction phase which commences in early 2025 with a peak of construction in Month 23 in late 2026. This therefore represents a worst case as the number of construction workers will vary and reduce over the period of construction.

11.4.2 As explained in **Section 11.1**, during operation of the Terminal and the hydrogen production facility, traffic levels would be low. The number of HGVs expected to access the Site during the operational phase is 48 per day in and out (96 two-way) and these would be associated with the hydrogen production facility. The number of worker vehicles is estimated at 53 per day in and out (106 two-way). Based on this volume of traffic, the levels are below the screening threshold for the assessment of highway links, i.e. where traffic flows will increase by more than 30% as outlined in the GEART (Ref 11-1). Therefore, in accordance with the approach set out in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), which was to review the need for assessment of operational traffic once further details of likely traffic levels were available, an assessment of the operational effects of the Project is scoped out.

11.4.3 Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) has confirmed the Applicant's view that significant traffic and transport effects during Project decommissioning are unlikely, assuming that a DEMP is secured via the DCO. Accordingly, this matter has been scoped out of the assessment.

11.4.4 This assessment therefore focusses on potential construction traffic effects, both from construction workers accessing the Site and HGV deliveries required during the construction phase.

Assessment of Significance

11.4.5 The GEART (Ref 11-1) includes guidance on how the sensitivity of receptors should be assessed. **Table 11-3** provides an overview of how the sensitivity of receptors close to or using transport links has been assessed based on that guidance.

Table 11-3: Link Sensitivity Categorisation

Receptors	Built Environment Indicator along Highway Link	Highway Link Sensitivity to Changes in Traffic Flow
People at home	Residential Properties	Medium: Where there are a number of properties with direct frontage to the highway link being used as a construction route.
		Low: Where there are few properties with direct frontage to the highway link being used as a construction traffic route.
People in workplaces	Offices, industrial units, employment uses	Low: Employment users therefore no residential impact, could already have HGV traffic.
Sensitive groups (children, elderly and disabled)	Schools, play areas, care/retirement homes, disabled parking bays	High: Where there are multiple indicators of sensitive groups with direct frontage onto the highway link being used as a construction traffic route
		Medium: Where one indicator of sensitive groups is present with direct frontage onto the highway link being used as a construction traffic route
		Low: Where no indicators of sensitive groups are present
Sensitive locations (hospitals, places of worship, schools, historic buildings)	Hospitals, places of worship, schools, historic buildings	High: Where there are multiple indicators of sensitive locations
		Medium: Where one indicator of a sensitive location is present
		Low:

Receptors	Built Environment Indicator along Highway Link	Highway Link Sensitivity to Changes in Traffic Flow
		Where no indicators of sensitive locations are present
People walking	Footways, PRoW, crossings	Medium: Indicators present on highway link
		Low: Indicators not present on highway link
People cycling	On/off-road designated cycle routes	Medium: On-road designated cycle routes present along highway link
		Low: Off-road designated cycle routes present along highway link
Open spaces, recreational sites, shopping areas	Parks, play areas, shops, community centers	High: Where there are multiple instances of indicators likely to be used by sensitive groups (i.e. children)
		Medium: Where one indicator is present that is likely to be used by sensitive groups (i.e., children)
		Low: Indicators that are unlikely to be used by sensitive groups
Road users	Roads, junctions, road classification, baseline traffic volumes, signage.	Determined by the presence of other affected parties in this table

11.4.6 The following transport related impacts have been considered within this assessment (residential and business amenity is included within **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**):

a. **Traffic and transport**: this is based upon the GEART (Ref 11-1) which sets out two rules for the assessment of traffic:

i Rule 1 – include highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%).

ii Rule 2 – include any other specifically sensitive areas where traffic flows will increase by 10% or more.

b. **Severance**: Severance occurs in a community when a major traffic artery separates people from places and other people. Severance occurs from difficulty of crossing a road or where the road itself creates a physical barrier. Severance can be caused to pedestrians or motorists. The GEART (Ref 11-1) suggest that changes in total traffic flow of 30%, 60% and 90% result in slight, moderate and substantial changes in severance respectively.

c. **Pedestrian amenity**: Pedestrian amenity is broadly defined as the relative pleasantness of a journey and is considered to be affected by factors such as traffic flow, traffic composition, pavement width and separation between vehicles and pedestrians. The impact manifests itself in fear and intimidation, exposure to noise and vehicle emissions. The GEART (Ref 11-1) suggest that a doubling or halving of total traffic flow or the HGV composition could lead to perceptible negative or positive impacts upon pedestrian amenity.

d. **Fear and intimidation**: The volume of traffic and its HGV composition are the factors that contribute to fear and intimidation. In the absence of thresholds set out in the GEART (Ref 11-1), this traffic and transport assessment considers that changes in total traffic flow of 30%, 60% and 90% are considered to result in slight, moderate or substantial impacts.

e. **Highway safety**: Highway safety is assessed by the frequency and severity of injury accidents that are attended by the police and recorded in official accident statistics. Intensification of use or changes in the composition of traffic has the potential to have an impact on collision rates. The examination of recent collision statistics on routes within the study area has highlighted any hotspots that need further examination.

f. **Hazardous loads**: These movements are assessed based on the estimated number and composition of such loads. Where the number of movements is considered to be significant, a risk analysis is required to determine the potential for an accident to happen and the likely effect of such an event.

11.4.7 **Table 11-4** sets out the criteria that have been used to assess the magnitude of traffic impacts for the impact types (a) to (f) listed above:

Table 11-4: Magnitude of Impact Criteria

Type of Impact	Magnitude of Impact			
	Very Low	Low	Medium	High
Traffic and transport	Occasional construction vehicles using roads over a short period of time.	Small number of construction vehicles using roads over a short period of time.	Moderate number of construction vehicles using roads over a protracted time period.	High number of construction vehicles using roads over a protracted period of time.

Type of Impact	Magnitude of Impact			
	Very Low	Low	Medium	High
	Less than 5% increase for more than six months; Between 6-15% increase for 3- 6 months; or Between 31-40% for less than three months.	6-15% increase for more than six months; 16-39% for 3-6 months; or More than 40% increase for less than three months.	16-39% increase for more than si months; or More than 40% increase for 3-6 months.	More than a 40% increase for more than 6 months.
Severance	Increase in total traffic flows of 29% or under (or increase in HGV flows under 10%).	Increase in total traffic flows of 30-59% (or increase in HGV flows of between 10% and 39%.	Increase in total traffic flows of 60-89% (or increase in HGV flows between 40% and 89%.	Increase in total traffic flows or HGV flows of 90% and above.
Pedestrian amenity	Increase in total traffic flows of 49% or under.	Increase in total traffic flows of 50-69%.	Increase in total traffic flows of 70-99%.	Increase in total traffic flows of 100% or above.
Fear and intimidation	Increase in total traffic flows or HGV flows of 29% or under (or increase in HGV flows under 10%).	Increase in total traffic flows of 30-59% (or increase in HGV flows of between 10% and 39%).	Increase in total traffic flows of 60%-89% (or increase in HGV flows between 40% and 89%).	Increase in total traffic flows or HGV flows of 90% and above.
Highway safety	Increase in total traffic flows of 30% or under (or increase in HGV flows under 10%).	All links estimated to experience increases in total traffic flows above 30% or increases in HGV flows above 10% are analysed further on a case-by-case basis.		
Hazardous loads	Risk assessed on a case-by-case basis depending on the material being transported, the number of loads and the proposed routing.			

11.4.8 The matrix in **Table 11-5** below has then been used to assess the significance of effect, based upon the magnitude of the impact taken from **Table 11-4** and the sensitivity of the receptor taken from **Table 11-3**.

Table 11-5: Significance of Effects Matrix

Magnitude of Impact	Sensitivity of receptor			
	High	Medium	Low	Very Low
High	Major – Significant	Major – Significant	Moderate – Significant	Minor – Not Significant
Medium	Major – Significant	Moderate – Significant	Minor – Not Significant	Negligible – Not Significant
Low	Moderate – Significant	Minor – Not Significant	Negligible – Not Significant	Negligible – Not Significant
Very Low	Minor – Not Significant	Negligible – Not Significant	Negligible – Not Significant	Negligible – Not Significant

11.5 Study Area

11.5.1 The Project is located in the vicinity of the Port of Immingham ("the Port"), which is owned and operated by ABP in an area that has substantial existing industrial presence.

11.5.2 The area of study is defined by roads where there may be potential for significant effects due to the additional traffic associated with the Project.

11.5.3 The following links have been included in the assessment; these define the traffic and transport study area (comprising the immediate network and the route to the Strategic Road Network), and were agreed by NELC through the Scoping exercise:

a. A180 East – between east of A180/A1173 Junction
b. A1173 – between A1173/Kiln Lane and A1173/Kings Road
c. Queens Road – between A1173/Kings Road and Queens Road/Laporte Road
d. Kings Road – between A1173/Kings Road and Kings Road/Pelham Road
e. Manby Road – between A160/Manby Road and Kings Road/Pelham Road
f. A160 – between Manby Road/A160 and A160/A1077 roundabout
g. A160 – between A160/A1077 roundabout and A160/A180
h. A180 West – between A180/A1173 and A180/A160
i. Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout

11.5.4 The extent of the traffic and transport study area is illustrated in **Figure 11.1 [TR030008/APP/6.3]**.

11.6 Baseline Conditions

Highway Network

11.6.1 The existing baseline highway network comprises an area that is largely industrial in nature, with very few residential properties other than in the north as the A1173 traverses the northern edge of Immingham. The only major residential area is the town of Immingham located to the south of the Port.

11.6.2 Queens Road is a single carriageway road providing a link from the Southern Port entrance towards the A1173, where it becomes Kings Road. Queens Road has a footway along the northern side and is street lit with right turn ghost islands into major side roads. Whilst the road is considered to be industrial in character, there are several dwellings and light industrial activities located along Queens Road adjacent to and opposite the northern boundary of the West Site.

11.6.3 Laporte Road is a single carriageway road located to the east of Queens Road, with which it forms a priority T-junction and continues south towards the Kiln Lane/Hobson Way/Laporte Road roundabout. The road has an existing 40mph limit on the approaches to both Queens Road and the Kiln Lane roundabout, with these being linked by a section of 60mph within the centre of the road link. There are no footways in place along Laporte Road.

11.6.4 Kings Road is a single carriageway road and connects with Queens Road to then form a three-arm roundabout junction with the A1173, where Kings Road then continues to the north to form a link into Immingham. The A1173 Manby Road then continues through the edge of Immingham to provide a link to the A160 in the north. It has street lighting and a footway heading northbound along one side of the road, and in the vicinity of the Site is considered to be industrial in character, although this does change to residential to the north as it enters Immingham.

11.6.5 The A1173, which is formed in part by Kings Road in the north, continues south as a single carriageway to form a three-arm roundabout with Kiln Lane before continuing south to form a grade separated junction with the A180. It is rural/industrial in nature and between Kings Road and Kiln Lane incorporates the Grimsby to Immingham Cycle Superhighway.

11.6.6 Approximately mid-way between the Kiln Lane roundabout and the junction with the A180 there is a roundabout on the A1173 which provides access into adjacent land, and there is a footway along the section leading to Kiln Lane, but no footway on the section leading to the A180.

11.6.7 Kiln Lane is a single carriageway and connects to the A1173 at a four-arm roundabout (A1173 heading both north and west). At this roundabout it also connects to several roads serving industrial estates (Stallingborough Industrial Estate and Industrial Estate South).

11.6.8 The A160 heads west from the A1173 and connects to the A180. Both of these links are part of the Strategic Road Network and are maintained by National Highways. The A180 heads east to Grimsby and west towards the closest motorway (M180) and provides the link from the local area to the wider highway network within the region.

11.6.9 **Figure 11.2 [TR030008/APP/6.3]** shows the local highway network in relation to the Project.

Public Transport

11.6.10 The nearest bus stops to the Site are located on Queens Road with bus stops with laybys on both sides of the road, with the westbound stop also including a shelter. These are served by service 5M providing a limited service between Immingham and Grimsby.

Cycle Networks and PRoW baseline

11.6.11 Whilst there are no National Cycle Network routes within the study area that would likely be affected by traffic associated with the Project, the Grimsby to Immingham Cycle Superhighway does run along the A1173 between the Kings Road and Kiln Lane roundabouts.

11.6.12 The locations of the PRoW within the vicinity of the Site are shown in **Figure 11.3 [TR030008/APP/6.3]**. Pedestrian facilities are limited on the local road network in the vicinity of the Project, with a footway along one side of Queens Road and along the northern side of the A1173 Kings Road providing a link into Immingham. Bridleway 36 commences on Laporte Road and runs north to the Humber, between proposed **Work No. 2** (jetty access road and pipe-rack) and proposed **Work No. 9** (Temporary Construction Area off Laporte Road).

Rail

11.6.13 The nearest railway stations to the Site are located at Habrough and Stallingborough which are approximately 6km west and 5km to the south respectively, with services operated by East Midlands Railway from both and TransPennine Express only from Habrough.

11.6.14 From Habrough during the week there is an hourly TransPennine Express service between Cleethorpes and Liverpool Lime Street, with East Midlands Railway operating a two-hourly service between Grimsby Town and Leicester via Lincoln and Nottingham as well as a two-hourly service between Cleethorpes and Barton-upon-Humber. On Sundays, the TransPennine Express service is two-hourly in the morning, but increases to hourly in the afternoon. During the summer months, there are three East Midlands Railway services between Nottingham and Cleethorpes and four services to Barton-upon-Humber with no services on either of these routes in the winter.

11.6.15 From Stallingborough, there is an East Midlands Railway weekday and Saturday service every two hours between Cleethorpes and Barton-upon-Humber, with a Sunday service of four trains per day in each direction during the summer months only, with no winter Sunday services at the station.

Road Safety

11.6.16 An analysis of traffic collision data within the study area, using data provided by NELC for a period of five years (2017-2022), has been undertaken, with the full set of data included within **Appendix 11.A [TR030008/APP/6.4]** and shown by location on **Figure 11.4 [TR030008/APP/6.3]**.

11.6.17 Traffic collision data by year and severity are shown in **Table 11-6**, and whilst some of the data in 2020 and 2021 may have been affected by COVID-19 restrictions, the use of data prior to 2017 in order to provide a full five-year analysis is not considered to be valid given that it would be at least six years old and may not reflect current conditions.

Table 11-6: Traffic Collision Data Analysis

	Year					
Severity	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Slight	9	11	11	10	17	4
Serious	4	7	5	9	0	3
Fatal	0	0	0	0	0	0

11.6.18 **Table 11-6** shows that there was a total of 90 collisions between 2017 and 2022 in this area. Of these, 62 were classified as slight, 28 were serious, with no fatal accidents being identified. There has only been one collision within the vicinity of the A1173/Kings Road roundabout, and as such this is not considered to be an accident hotspot.

11.6.19 As illustrated on **Figure 11.4 [TR030008/APP/6.3]**, the majority of the accidents have occurred within the built up area of Immingham. No construction HGV traffic associated with the Project would be routed through this residential area. At the A1173/A180 junction there have been a total of four accidents (three slight and one serious) and again, whilst any incident is undesirable, this is not considered to constitute an existing road safety issue at this location.

11.6.20 Overall, it is concluded that there are no existing highway safety issues on the traffic routes which would be used by traffic associated with the Project, which would need to be addressed as part of the Project.

Existing Traffic Flows

11.6.21 Baseline 24 hour Annual Average Daily Traffic (“AADT”) two-way link flows for the study area are presented in **Table 11-7**, including the percentage of HGVs. The data has been obtained from the Transport Assessment (Ref 11-9) that supports the proposed IERRT development. It should be noted that Queens Road/Kings Road has been divided into two distinct sections based upon the location of the western and eastern construction sites due to the differing levels of construction traffic (as set out in **Section 11.7**) and the sensitivity of each section based upon the criteria outlined in **Table 11-3**.

11.6.22 The Link Sensitivity included in **Table 11-7** is based upon the criteria given in **Table 11-3**, with all links being low sensitivity except Link 4, Queens Road between Kings Road and Laporte Road, which has a medium sensitivity due the protected characteristics associated with the residential properties. The low sensitivity of Kings Road between the A1173 and Queens Road is based upon there not being any residential properties along this section.

Table 11-7: 2021 Baseline AADT Traffic Flows

Link	Link Description	Link Sensitivity	2021		
			All Vehicles	HGV	HGV %age
1	A180 East - between east of A180/A1173 Junction	Low	34,246	3,253	9%
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road	Low	7,384	795	11%
3	Kings Road - between A1173 and Queens Road	Low	3,883	566	15%
4	Queens Road between Kings Road and Laporte Road	Medium	3,883	566	15%
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	Low	7,722	568	7%
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road	Low	7,415	1,139	15%
7	A160 - Between Manby Road/A160 and A160/A1077 roundabout	Low	10,536	5,048	48%

Link	Link Description	Link Sensitivity	2021		
			All Vehicles	HGV	HGV %age
8	A160 - between A160/A1077 Roundabout and A160/A180	Low	12,102	5,328	44%
9	A180 West - between A180/A1173 and A180/A160	Low	25,546	3,837	15%
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way Roundabout	Low	3,534	583	16%

Source: Ref 11-9

Future Baseline

11.6.23 Subject to consent being granted for the Project, there would be a phased approach to construction, with the construction of the terminal and the first phase of the hydrogen processing facility expected to start in early 2025 and last for between two and a half and three years.

11.6.24 Following completion of the first phase of the construction, a further five phases of the hydrogen production facility will be constructed incrementally to increase the processing capacity as the market for green hydrogen increases. There will therefore be six phases of development in total.

11.6.25 For the purposes of this chapter, a development scenario has been defined based on a six-phase construction timeline through to full completion of all phases over an indicative eleven-year period. This programme duration is likely to be a worst case in EIA terms. This is because although market demand could accelerate the programme for Phases 2-6, Phase 1 would always represent the peak of construction, irrespective of the subsequent programme for Phases 2 onwards.

11.6.26 The peak level of construction traffic is expected in Month 23, which based upon a start in early 2025, is expected to be in late 2026, and this year has therefore been used as the future assessment year.

11.6.27 Future year baseline traffic flows for the assessment year of 2026 for the peak of construction have been derived by applying the national standard programme Trip End Model Presentation Program ("TEMPRO") to derive a traffic growth factor, as indicated in **Table 11-8**. This growth factor has been taken into account when comparing the baseline and future traffic scenarios.

Table 11-8: Traffic Growth Factor

Year	Growth Factor
2021 - 2026	1.0703

11.6.28 The peak of construction 2026 baseline traffic flows have been calculated and are shown in **Table 11-9**, with the TEMPRO growth factor providing an allowance for both growth in background traffic as well some additional levels of development.

Table 11-9: 2026 Baseline AADT Traffic Flows

Link	Link Description	2026		
		All Vehicles	HGV	HGV %age
1	A180 East - between east of A180/A1173 Junction	36,653	3,482	9%
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road	7,903	851	11%
3	Kings Road - between A1173 and Queens Road	4,156	606	15%
4	Queens Road between Kings Road and Laporte Road	4,156	606	15%
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	8,265	608	7%
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road	7,936	1,219	15%
7	A160 - between Manby Road/A160 and A160/A1077 roundabout	11,277	5,403	48%
8	A160 - between A160/A1077 Roundabout and A160/A180	12,953	5,702	44%
9	A180 West - between A180/ A1173 and A180/A160	27,342	4,107	15%

Link	Link Description	2026		
		All Vehicles	HGV	HGV %age
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout.	3,783	624	16%

11.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

11.7.1 The Project has been designed, as far as possible, to avoid and minimise environmental impacts and effects through the process of design development, and by embedding mitigation measures into the design.

11.7.2 The construction phase has been designed to minimise waste and materials as far as possible in order to minimise the need for traffic trips to the Site. This will be achieved through the pre-fabrication of elements where practicable which will then be brought to the Site. In addition, it is expected that a high proportion of the materials and components used in the construction of the marine elements of the Project would be brought in by ship to the Port. Large pre-assembled parts of the hydrogen production facility are also likely to be brought in by ship to the Port. The adoption of these measures and assumptions within the overall approach to construction reduces the number of vehicle trips that would typically be required on the network, and accordingly this reduction has been reflected in the construction traffic flows used in the assessment.

11.7.3 All permanent access points to the work areas that require the creation of a junction bell-mouth will be designed based on the relevant standard, DMRB CD 123 Geometric Design of at Grade Priority and Signal-Controlled Junctions (Ref 11-6), and in consultation with the local highway authority, thereby negating any potential safety impact associated with construction activity. Illustrative designs for each access point are provided at **[TR030008/APP/4.3]** as part of the wider DCO application and demonstrate appropriate consideration of location, sight-lines and vehicle swept paths.

Standard Mitigation Measures

11.7.4 The main approach to mitigating potential traffic impacts would be through the use of management measures to reduce as far as possible the number of vehicle trips on the local highway network.

11.7.5 Prior to the start of the construction phase, the contractor will prepare a CTMP to control HGV movements, as well as a CWTP to control the trips made by the construction workers (including encouraging car sharing) and thus reduce the impact of the workforce upon the highway network. The CTMP and CWTP would be based on, and incorporate, the contents and requirements of the **OCTMP** and **OCWTP [TR030008/APP/6.7]**.

11.7.6 The CTMP and CWTP would set out measures and controls to limit the number of trips on the network in the peak hours, and as such would limit the traffic impact of the construction phase as far as possible. The plans would be implemented for the duration of the construction phase.

11.7.7 With reference to the **OCWTP [TR030008/APP/6.7]**, the contractor will implement a car sharing scheme to reduce the number of single occupancy trips, with an average of 1.5 workers per car considered to be achievable.

11.7.8 This is considered a realistic assumption given that the mode of arrival of construction workers can be controlled through travel planning measures and that construction workers would want to minimise their travel expenditure, particularly if having to pay for temporary accommodation. It is proposed that this level of traffic generation can be managed and maintained through the CWTP measures and the availability of onsite parking spaces.

11.8 Trip Distribution, Generation and Assignment

11.8.1 This section provides an overview of the trip distribution, generation and assignment associated with the construction, operation and decommissioning phases at the Site, and the potential impacts, and reflects the embedded and standard mitigation measures as set out above.

Construction

Construction Phase Traffic Generation

11.8.2 The trip generation flows during the construction phase set out the daily HGV numbers and daily workforce associated for each phase of Project construction. This provides for all vehicles associated with the construction of the landside aspect as well as the marine construction, including all waste removal along with the associated workforce.

11.8.3 The first phase of construction works (2025-2027) is predicted to generate the largest number of HGVs and daily workforce trips, and this is the phase that has been assessed as representing the reasonable worst case scenario.

11.8.4 The peak month during the first phase of construction works has been identified as Month 23 in late 2026. For the terrestrial construction programme, this will involve a total workforce of 919 personnel on-site, which equates to a total of 612 car movements based upon an average of 1.5 workers per car.

11.8.5 In addition, there are also 220 personnel associated with the marine construction works in which 20% are assumed to car share or use public transport which equates to a total of 176 personnel arriving by car each day.

11.8.6 The number of HGV movements associated with the terrestrial construction is estimated at 71 HGV movements per day, one-way. For the marine construction programme, the HGV numbers would be substantially lower with many materials and components arriving by sea and it is estimated to generate a total of 10 two-way HGV trips per day.

11.8.7 In addition, there will be a number of HGV trips associated with the waste onsite, and this is estimated be an average of 23.4 HGV movements per day, one-way, which is comprised of the following, and to ensure a robust assessment a figure of 24 HGVs has been used in the assessments within this chapter.

a. Landside construction phase 1.14 waste vehicles

b. Landside excavated material, two waste vehicles

c. Jetty construction, seven waste vehicles

d. Jetty excavated material, 0.4 waste vehicles

11.8.8 The other six phases of the Project construction would generate at least 50% less traffic than the peak which has been assessed in this chapter.

11.8.9 The predicted daily trip generation during the peak Project construction works (i.e. Month 23) is shown in **Table 11-10**.

Table 11-10: Total Daily Construction Traffic – Peak of Construction

	Type	To	From	Two-Way
Terrestrial and Jetty	HGVs (including waste)	Terrestrial 71 Waste 24 Jetty 4	Terrestrial 71 Waste 24 Jetty 4	Terrestrial 142 Waste 48 Jetty 8
	Landside Workers (assuming 919 workers with an average car occupancy of 1.5)	612	612	1,224
	Marine Workers (assuming 220 workers with an average car occupancy of 1.5)	147	147	294
All Vehicles		**Workers 759** **HGVs 99**	**Workers 759** **HGVs 99**	**Workers 1,518** **HGVs 199**

11.8.10 **Table 11-10** shows there would be a total of 1,518 two-way worker trips and 199 HGV trips generated at the peak of construction, to and from the Site.

11.8.11 The above construction activity will occur across both the western and eastern sites, with the western site located adjacent to the A1173/Kings Road and the eastern site located adjacent to Queens Road/Laporte Road. Therefore, not all construction traffic will use the full length of Kings Road/Queens Road; the split is shown in **Table 11-11**, with the majority only using Kings Road in the north.

Table 11-11: Construction Site Traffic Split between the West and East Sites

Construction Site	Landside Construction Workers	Marine Construction Workers	Construction HGVs
West Site (A1173/Kings Road)	80%	-	70%
East Site (Queens Road/ Laporte Road)	20%	100%	30%

11.8.12 The above total construction HGV and construction worker flows from **Table 11-10** can then be shown by the western and eastern sites based upon the percentage splits from **Table 11-11**, as shown in **Table 11-12**.

Table 11-12: Daily Construction Traffic by Site (Two-Way)

Construction Site	Two-Way Construction Workers (assuming an average car occupancy of 1.5)	Marine Workers (assuming 20% travel by carshare or public transport)	Two-Way Construction HGVs
Western Site (A1173/Kings Road)	979		139
Eastern Site (Queens Road/ Laporte Road)	245	232	59
Total	**1,224**	**232**	**199**

11.8.13 Therefore, from the total of 199 HGVs two-way per day, only 59 would then travel past the residential properties on Queens Road, with the remainder travelling to and from the western site adjacent to the A1173/Kings Road.

11.8.14 It should also be noted that the marine worker traffic total is 232 and not the total of 294 as from **Table 11-11** 21**%** will travel from Laporte Road and 79% will travel along Kings Road/Queens Road to access other routes. Therefore only 79% (232 vehicles) will travel along Kings Road/Queens Road with 21% (62 vehicles travelling along Laporte Road.

Construction Phase Daily Traffic Profile

11.8.15 Working hours on major construction sites tend to be long due to pressures of timescales and available light. Therefore, the arrival and departure of workers vehicles tend to be spread over the peak periods rather than all falling in the traditional network AM (08:00-09:00) and PM (17:00-18:00) peak hours. In an attempt to quantify this, previous discussions have been held with contractors where it was revealed that there is a general tendency for construction workers to travel early in order to avoid congestion and delay.

11.8.16 **Table 11-13** below sets out the percentage of daily inbound and outbound trips on an hour-by-hour basis and calculates the totals for the peak month of construction, including the marine workforce (Month 23). This profile is based on a count undertaken at the construction site entrance to Ferrybridge Multifuel 2 in 2017 and has been accepted on previous Environmental Assessments, and the daily traffic profile is set out in **Table 11-13** below.

Table 11-13: Construction Worker Traffic Daily Profile

Hour Beginning	Percentage split based upon survey and a working day between 07:00 and 19:00		Arrivals	Departures	Two Way
	Percentage of Daily inbound trips	Percentage of daily outbound trips			
0600	34%	2%	258	15	273
0700	25%	2%	190	15	205
0800	5%	2%	38	15	53
0900	4%	2%	30	15	46
1000	4%	3%	30	23	53
1100	4%	3%	30	23	53
1200	5%	4%	38	30	68
1300	4%	4%	30	30	61
1400	3%	3%	23	23	46
1500	2%	3%	15	23	38
1600	2%	5%	15	38	53
1700	3%	15%	23	114	137
1800	3%	35%	23	266	288
1900	2%	16%	15	121	137
2000	0%	1%	0	8	8
2100	0%	0%	0	0	0
Total	100%	100%	759	759	1518

11.8.17 Therefore during the weekday AM peak,08:00 to 09:00 there is anticipated to be 53 worker trips and during the weekday PM peak 17:00 to 18:00 there is anticipated to be 137 worker trips on the road network.

11.8.18 The daily profile of HGV movement at the peak of construction, Month 23, is shown in **Table 11-14**, and is based on previous experience from construction sites and shows that the arrival and departure of HGVs from the Site is anticipated to be spread evenly over the day, and has been used previously within Environmental Assessments.

Table 11-14: HGV Traffic Daily Profile

Hour Beginning	Percentage of Daily inbound trips	Percentage of daily outbound trips	Arrivals	Departures	Two Way
600	0%	0%	0	0	0
700	9%	8%	10	8	18
800	9%	8%	9	8	17
900	9%	8%	9	8	17
1000	9%	8%	9	8	17
1100	9%	8%	9	8	17
1200	9%	8%	9	8	17
1300	9%	8%	9	8	17
1400	9%	8%	9	8	17
1500	9%	8%	9	8	17
1600	9%	8%	9	9	18
1700	9%	8%	9	9	18
1800	0%	8%	0	10	10
1900	0%	0%	0	0	0
2000	0%	0%	0	0	0
2100	0%	0%	0	0	0
	100%	100%	100	100	200

11.8.19 The above shows that during the weekday AM and PM peak periods, 08:00 to 09:00 and 17:00 to 18:00 respectively there would be a maximum of 18 HGVs on the road network, which is not considered to represent a severe impact.

Construction Phase Traffic Distribution

Worker Distribution

11.8.20 Construction worker trip distribution to the Project has been based on 2011 census data using WU03EW – Location of usual residence and place of work by method of travel to work Middle layer Super Output Areas ("MSOA" level) for North East Lincolnshire 001 (Ref 11-8). This is considered reasonable as it covers the residential area of Immingham, as well as the Port area where the Project would be located.

11.8.21 The construction workforce is anticipated to travel to the Site via the existing trunk road and local road networks via private car, with a distribution based upon Census Journey To Work data (Ref 11-8) for the local area, which gives the distribution set out in **Table 11-15**.

Table 11-15: Construction Worker Distribution

Route	Distribution
Laporte Road	21%
Manby Road	8%
Pelham Road	20%
A180 (W)	9%
A180 (E)	26%
A1173 (S)	16%
TOTAL	100%

11.8.22 This distribution pattern is then applied to the assumed worker trips as set out in **Table 11-16**.

Table 11-16: Construction Worker Traffic Distribution

Route	Landside		Marine	
	Assumed Number of Workers at the Peak Month	Assumed Number of Worker Car Trips (Based Upon an Average of 1.5 Workers per Car)	Assumed Number of Workers at the Peak Month	Assumed Number of Worker Car Trips (Based Upon an Average of 1.5 Workers per Car)
Laporte Road	193	128	31	37
Manby Road	76	51	12	14
Pelham Road	180	120	29	35
A180 (West)	87	58	13	16
A180 (East)	240	160	38	46
A1173 (South)	142	95	23	28
TOTAL	919	612	147	176

11.8.23 In order to provide further detail, the construction worker traffic flow distribution on Kings Road/Queens Road for each of the western and eastern sites is set out in **Table 11-17**, as the traffic is comprised of workers travelling to and from each site as well as those workers travelling to and from Laporte Road.

Table 11-17: Construction Worker Daily Traffic Distribution (Two-Way) Landside Only

	Western Site			Eastern Site			TOTAL
	Travelling to/from Laporte Road (21%)	Travelling to/from remainder of the network (79%)	Western site total	Travelling to/from Laporte Road (21%)	Travelling to/from remainder of the network (79%)	Eastern site total	
Link 3 - Kings Road - between A1173 and Queens Road	206	773	**979**		194		1,173
Link 4 - Queens Road between	205			51	194	**245**	450

	Western Site			Eastern Site			TOTAL
	Travelling to/from Laporte Road (21%)	Travelling to/from remainder of the network (79%)	Western site total	Travelling to/from Laporte Road (21%)	Travelling to/from remainder of the network (79%)	Eastern site total	
Kings Road and Laporte Road							

11.8.24 With reference to **Table 11-17** above, for the western site, the traffic flow on Link 3 Kings Road - between A1173 and Queens Road is comprised of all worker trips, regardless of their destination, whereas for Link 4 Queens Road between Kings Road and Laporte Road it only comprises of those workers traveling to and from Laporte Road.

11.8.25 Similarly for the eastern site, Link 3 Kings Road - between A1173 and Queens Road only comprises those workers travelling to destinations other than Laporte Road, and Link 4 Queens Road between Kings Road and Laporte Road comprises all workers, regardless of their destination, traveling to the eastern site.

11.8.26 As set out above in **Table 11-12**, 79% (232 vehicles daily) associated with the Marine side of the construction will travel along Link 3 Kings Road and Link 4 Queens Road as such this hasn't been included within the table above.

11.8.27 From the worker distribution set out in **Table 11-15** and the daily profile from **Table 11-13** the additional construction worker trips on the wider highway network during the weekday AM and PM peak periods can be set out as follows in **Table 11-18**.

Table 11-18: Construction Worker Weekday Peak Traffic

Route	Distribution	Construction weekday AM Peak worker trips	Construction weekday PM Peak worker trips
Laporte Road	21%	51	61
Manby Road	8%	19	23
Pelham Road	20%	49	58
A180 (W)	9%	22	26
A180 (E)	26%	63	75
A1173 (S)	16%	39	46
TOTAL	100%	243	288

11.8.28 The above level of additional trips associated with construction workers in the weekday AM and PM peak hours as set out in **Table 11-18** above, with a maximum flow of 75 on the A180(E) which equates to around 1.25 extra vehicles per minute, which would be within any daily variation, and would be controlled and mitigated through the CWTP.

HGV Distribution

11.8.29 In relation to HGV distribution, it is assumed that all construction vehicles would travel to and from the Site via the A1173 towards the A180 where they have been distributed based upon the existing pattern of movements. No HGVs are distributed through the residential area of Immingham to the north, in order to avoid travelling past the residential property adjacent to the A1173. The only exception to this would be Abnormal Indivisible Loads ("AIL") to the Site from the Port, and these would be strictly controlled by both the Police and Local Authority to minimise any impact, as set out in Section 4 of the CTMP **[TR030008/APP/6.7]**

11.8.30 The predicted distribution of HGVs is provided in **Table 11-19**.

Table 11-19: HGV Distribution

Route	Distribution
A180 (West)	55%
A180 (East)	45%
TOTAL	100%

11.8.31 This distribution pattern is then applied to the predicted HGV numbers for the peak month (Month 23) as set out in **Table 11-20**.

Table 11-20: HGV Daily Distribution

Route	Assumed Number of HGV Trips (One-Way)
A180 (West)	55
A180 (East)	45
TOTAL	100

11.8.32 All of the above HGV trips would then travel to and from the M180 via the A1173, and the only exception to the above would be any AIL which would use the A1173 Kings Road to access the Site under controlled conditions.

Construction Phase Link Flows

11.8.33 Based on the trip distribution exercise and the proposed trip generation provided above, Table 11-21 outlines the number of trips on each of the links within the defined study area during the peak construction year (2026).

Table 11-21: Construction Trip Assignment – Peak of Project Construction

Link	Link Description	Peak Construction Traffic		
		All Vehicles	Workers	HGVs
1	A180 East - between East of A180/A1173 Junction	487	397	91
2	A1173 - between A1173/ Kiln Lane and A1173/Kings Road	975	775	200
3	Kings Road - between A1173 and Queens Road	1605	1405	200
4	Queens Road between Kings Road and Laporte Road	743	683	60
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	424	424	0
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road	126	126	0

Link	Link Description	Peak Construction Traffic		
		All Vehicles	Workers	HGVs
7	A160 - Between Manby Road/A160 and A160/ A1077 roundabout	126	126	0
8	A160 - between A160/ A1077 roundabout and A160/A180	0	0	0
9	A180 West - between A180/A1173 and A180/ A160	252	143	109
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout.	319	319	0

11.8.34 The trip assignment data set out in Table 11-21 forms the basis of the traffic and transport assessment set out within **Section 11.9**.

Operation

11.8.35 The trip generation during the operational phase is estimated to be 120 employee trip movements, with 67 working a shift pattern and 53 working a “normal” Monday to Friday. This would represent less than one additional car per minute travelling to and from the operational site in the traditional AM and PM peak hours, based upon the 53 employees working a traditional week, with all trips assumed to be new on the highway network. The shift workers would travel outside of the peak hours and therefore would not result in a severe impact on the operation of the highway network.

11.8.36 **Table 11-22** sets out the estimated total daily development traffic associated with the operational phase.

Table 11-22: Total Daily Operational Traffic

Type	To	From	Two-Way
HGVs	48	48	96
Shift Workers	67	67	134
“Normal” Monday to Friday workers	53	53	106
Total	168	168	336

11.8.37 From the above table there is only anticipated to be a total of 53 workers travelling in the peak hours, assuming a worst case that all will drive in a single occupancy vehicle, with 53 arriving in the weekday AM peak and 53 departing in the weekday PM peak.

11.8.38 From the worker distribution set out in **Table 11-15** the additional operational worker trips are set out in **Table 11-23**.

Table 11-23: Operational Worker Distribution

Route	Distribution	Operation weekday AM Peak worker trips	Operation weekday PM Peak worker trips
Laporte Road	21%	11	11
Manby Road	8%	4	4
Pelham Road	20%	11	11
A180 (W)	9%	5	5
A180 (E)	26%	14	14
A1173 (S)	16%	8	8
TOTAL	100%	5	53

11.8.39 The level of additional trips set out in **Table 11-20** is not considered to represent a severe impact upon either the local or SRN.

11.8.40 There would also be a total of 48 HGVs in and out during the day (96 two-way movements) associated with the operational hydrogen production facility. It is assumed that these HGV movements would be spread out during the day and on a 24-hour basis. This equates to an average of around four HGV two way per hour (two arrivals and two departures).

11.8.41 Based on this volume of traffic, with staff working shifts and only around four HGVs per hour, the levels are below the screening threshold of including highway links where traffic flows would increase by more than 30% for assessment outlined in the GEART (Ref 11-1). For this reason and as explained above, an operational traffic and transport assessment of the Project was scoped out.

Decommissioning

11.8.42 Given that both the number of traffic movements associated with this phase as well as the operation of the highway network at that time are uncertain, no further assessment of this phase has been undertaken.

11.8.43 This approach was agreed by the Planning Inspectorate in their response dated 10 October 2022 subject to the provision of an **Outline DEMP [TR030008/APP/6.6]** being secured through the DCO.

11.9 Assessment of Likely Impacts and Effects

11.9.1 With reference to **Table 11-3** above and based on the nature of the land use and the local highway network, the sensitivity of all traffic and transport links (save Link 4 Queens Road) within the study area is considered to be low. Queens Road has is considered to have a medium sensitivity due the residential dwellings which accommodate some residents with protected characteristics.

Construction

11.9.2 Based upon the 2026 future baseline traffic flows and the construction traffic flows provided above, **Table 11-24** provides the total percentage increase for total vehicles and HGVs on each of the links within the study area, during the peak construction year.

Table 11-24: 2026 Base + Peak of Construction Daily Two-Way Flows

Link No.	Link Description	Sensitivity	2026 Baseline Flow		Construction Traffic		Percentage Increase	
			Total Vehicles	Total HGV	Total Vehicles	Total HGV	Total Vehicles	Total HGV
1	A180 East - between East of A180/A1173 Junction	Low	36,653	3,482	487	91	1%	3%

Link No.	Link Description	Sensitivity	2026 Baseline Flow		Construction Traffic		Percentage Increase	
			Total Vehicles	Total HGV	Total Vehicles	Total HGV	Total Vehicles	Total HGV
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road	Low	7,903	851	975	200	12%	24%
3	Kings Road - between A1173 and Queens Road	Low	4,156	606	1605	200	39%	33%
4	Queens Road between Kings Road and Laporte Road	Medium	4156	606	743	60	18%	10%
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	Low	8265	608	424	0	5%	0%
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road	Low	7,936	1,219	126	0	2%	0%
7	A160 - Between Manby Road/A160 and A160/A1077 roundabout	Low	11,277	5,403	126	0	1%	0%

Link No.	Link Description	Sensitivity	2026 Baseline Flow		Construction Traffic		Percentage Increase	
			Total Vehicles	Total HGV	Total Vehicles	Total HGV	Total Vehicles	Total HGV
8	A160 - between A160/A1077 roundabout and A160/ A180	Low	12,953	5,702	0	0	0%	0%
9	A180 West - between A180/A1173 and A180/A160	Low	27,342	4,107	252	109	1%	3%
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout	Low	3,783	624	319	0	8%	0%

11.9.3 **Table 11-24** indicates that for most of the links within the study area the impact is substantially below 30% for both the total vehicle number and total HGVs, with the increase in HGVs being below 30% on all links, except Link 3 Kings Road between the A1173 and Queens Road which has a low sensitivity and would experience an increase of 39% in all traffic and a 33% increase in HGVs.

11.9.4 Based upon the above percentage increases in traffic at the peak year of construction, 2026, **Table 11-25** provides an overview of the magnitude of impact of proposed peak construction traffic on each of the transport related impacts from **Table 11-3**, based upon the magnitude of impact criteria as set out in **Table 11-4**.

11.9.5 The effects on the local road network, based on:

a. The sensitivity of each link (low for each, except the medium sensitivity of Link 4).

b. The magnitudes of impact from **Table 11-21** can then be summarised as follows:

11.9.6 With reference to the GEART (Ref 11-1) and as explained above in **Section 11.4**, a two rule approach has been used to assess the extent of any traffic assessment as follows:

a. Rule 1: include highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%).

b. Rule 2: include any other specific sensitive areas where traffic flows have increased by 10% or more.

11.9.7 Given that:

a. The local highway network is deemed to have a low sensitivity (save for medium sensitivity Queens Road).

b. The only links to experience a potential effect are along the A1173, Kings Road and Queens Road.

c. No other road links are predicted to experience an adverse impact.

11.9.8 No further assessment is required of these links is required.

11.9.9 However, both the A1173 and Kings Road have a low sensitivity and as such the effect on both is minor, **not significant**.

11.9.10 Whilst it has a medium sensitivity, the effect on Queens Road is minor, **not significant** due to the low or very low magnitude of impact.

11.9.11 The following sections summarise the likely effects on receptors in terms of severance, pedestrian amenity, fear and intimidation and highway safety.

Severance

11.9.12 In terms of severance, the GEART (Ref 11-1) states that changes in traffic flow of 30%, 60% and 90% are registered as producing slight, moderate and substantial changes respectively (see **Section 11.4**). The magnitude of impact is therefore assumed to be very low for all receptors apart from Kings Road, Queens Road and the A1173 between Kiln Lane and Kings Road where is it assessed as being low due to the increase in HGV traffic of between 10% and 39%. Therefore, the effect for severance would be very low to low **(not significant).**

Pedestrian Amenity

11.9.13 For pedestrian amenity, the GEART (Ref 11-1) states that an indicative threshold would be where the traffic flow (or its lorry component) is halved or doubled (see **Section 11.4**). The magnitude of impact is therefore assessed to be very low for all receptors considered, and therefore the effect for pedestrian amenity would be low (**not significant**).

Fear and Intimidation

11.9.14 Fear and intimidation relate to the impact traffic may have on pedestrians with no commonly agreed threshold for estimating levels of danger or fear and intimidation (see **Section 11.4**). The numbers of pedestrians on the HGV route to the A180 along the A1173 is very low. The impact is therefore considered to be very low for all links apart from on Kings Road, Queens Road and the A1173 between Kiln Lane and Kings Road where it is considered to be low. Therefore, the effect on fear and intimidation would be very low to low (**not significant**).

Road Safety

11.9.15 For road safety, as there is not considered to be an existing accident issue on the local highway (see **Section 11.6**), all impacts will therefore be very low. Therefore, the effect on road safety is very low (**not significant**).

Hazardous Loads

11.9.16 It is envisaged that there will only be a very occasional requirement for hazardous loads, and as such, the impact is considered to be very low. Therefore, the effect on hazardous loads is very low (**not significant**).

Table 11-25: Magnitude of Impact

Link No.	Link Description	Sensitivity	Percentage Increase		Traffic and Transport	Severance	Pedestrian Amenity	Fear and Intimidation	Highway Safety
			Total Vehicles	Total HGV					
1	A180 East - between east of A180/A1173 Junction	Low	1%	3%	Very Low	Very Low	Very Low	Very Low	Very Low
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road	Low	12%	24%	Medium	Low	Very Low	Low	Very Low
3	Kings Road - between A1173 and Queens Road	Low	39%	33%	Medium	Low	Very Low	Low	Very Low
4	Queens Road between Kings Road and Laporte Road	Medium	18%	10%	Low	Low	Very Low	Low	Very Low
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	Low	5%	0%	Very Low	Very Low	Very Low	Very Low	Very Low
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road	Low	2%	0%	Very Low	Very Low	Very Low	Very Low	Very Low
7	A160 - between Manby Road/A160 and A160/A1077 roundabout	Low	1%	0%	Very Low	Very Low	Very Low	Very Low	Very Low

Link No.	Link Description	Sensitivity	Percentage Increase		Traffic and Transport	Severance	Pedestrian Amenity	Fear and Intimidation	Highway Safety
			Total Vehicles	Total HGV					
8	A160 - Between A160/A1077 roundabout and A160/A180	Low	0%	0%	Very Low	Very Low	Very Low	Very Low	Very Low
9	A180 West - between A180/A1173 and A180/A160	Low	1%	3%	Very Low	Very Low	Very Low	Very Low	Very Low
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way Roundabout.	Low	8%	0%	Low	Very Low	Very Low	Very Low	Very Low

11.9.17 As indicated in **Table 11-25**, the majority of the links assessed would experience a low or very low magnitude of impact for each type of impact considered. The exceptions are Link 2 (A1173 between A1173/Kiln Lane and A1173/Kings Road) and Link 3 (Kings Road - between A1173 and Queens Road), which would experience a medium impact for some of the assessment criteria.

11.9.18 Based upon the impact magnitudes defined in **Table 11-25** and the low sensitivity of the network on all links except Queens Road which has a medium sensitivity, the predicted traffic and transport-related effects during the peak construction year (2026) are summarised in **Table 11-26**.

Table 11-26: Classification of Traffic and Transport Effects (during Peak Construction year 2026)

Link No.	Link Description	Traffic and Transport	Severance	Pedestrian Amenity	Fear and Intimidation	Highway Safety
1	A180 East - between east of A180/A1173 Junction	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road	Minor Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
3	Kings Road - between A1173 and Queens Road	Minor Not Significant	Minor Not significant	Negligible Not significant	Minor Not significant	Negligible Not significant
4	Queens Road between Kings Road and Laporte Road	Minor Not Significant	Minor Not Significant	Minor Not Significant	Minor Not Significant	Negligible Not significant
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
6	Manby Road - between A160/Manby Road and Kings	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant

Link No.	Link Description	Traffic and Transport	Severance	Pedestrian Amenity	Fear and Intimidation	Highway Safety
	Road/Pelham Road					
7	A160 - between Manby Road/A160 and A160/A1077 roundabout	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
8	A160 - between A160/A1077 roundabout and A160/A180	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
9	A180 West - between A180/A1173 and A180/A160	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant	Negligible Not significant

11.9.19 This assessment of the traffic and transport effects for the Project has concluded that the traffic and transport effects within the defined study area would be negligible, not significant, with the exception being Link 2 (A1173 - between A1173/Kiln Lane and A1173/Kings Road), Link 3 (Kings Road, between A1173 and Queens Road) and Link 4 (Queens Road between Kings Road and Laporte Road) where the effect is minor, **not significant**.

11.9.20 However, it is anticipated that the residential use of certain properties on the west side of Queens Road would cease as residential use is not considered compatible with the operation of the hydrogen production facility on the West Site (**Work No. 7**). Discussions are ongoing with the owners and occupiers and, where it is not possible to acquire those properties through negotiation, acquisition powers for these properties are sought through the draft DCO **[TR030008/APP/2.1]**, which also includes a requirement to secure the permanent cessation of the residential use. In the event of acquisition of all relevant residential properties for the Project ahead of the construction works commencing, the minor, not significant, effect on those properties, as assessed in this chapter in respect of Link 4 (Queens Road, between Kings Road and Laporte Road) would not arise.

Operation

11.9.21 As set out in **Section 11.7**, the overall traffic generation during the operational phase is considered to be below the GEART threshold of a 30% increase in traffic, and therefore no assessment has been undertaken.

Decommissioning

11.9.22 As set out in **Section 11.7**, the assessment of the decommissioning phase was scoped out of the ES, and as such no assessment has been undertaken.

11.10 Mitigation and Enhancement Measures

11.10.1 Embedded and standard mitigation measures for traffic and transport have been included within **Section 11.7** through the adoption of the OCTMP and OCWTP **[TR030008/APP/6.7]** in order to control construction vehicle numbers.

11.10.2 Therefore, no further additional measures have been included to mitigate the reported effects.

11.11 Cumulative Effects

11.11.1 The assessment presented in this chapter and within **Appendix 11.B [TR030008/APP/6.4]** inherently includes an assessment of construction related traffic cumulative effects with other shortlisted developments. In summary, no significant cumulative effects are predicted. This is further described in **Chapter 25: Cumulative Effects and In-Combination Assessment [TR030008/APP/6.2]**.

11.12 Assessment of Residual Effects

11.12.1 Based upon the assessment as detailed in **Section 11.8**, no residual effects with regards to traffic and transport are anticipated.

11.13 Summary of Assessment

11.13.1 Based on the current understanding of traffic and transport associated with the Project, no significant effects are anticipated. A summary of potential traffic and transport impacts and mitigation measures is presented in **Table 11-27**. The assessment indicates that traffic and transport effects associated with the peak construction phase for the Project within the study area, taking into account the adoption of the OCTMP and OCWTP **[TR030008/APP/6.7]** measures, would be negligible or minor, and therefore not significant, on all links.

Table 11-27: Summary of Impacts, Mitigation Measures and Effects/Residual Effects during construction

Link No.	Receptor (Sensitivity)	Impact Pathway	Effect (with Embedded and Standard Mitigation)	Mitigation Measure	Effect/Residual Effect	Confidence
Construction						
1	A180 East - between east of A180/A1173 Junction (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance and the implementation of a CTMP/CWTP to control the traffic movements during the critical; construction phase.
2	A1173 - between A1173/Kiln Lane and A1173/Kings Road (Low)	Traffic flows	Minor	No additional mitigation	Minor (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.

Link No.	Receptor (Sensitivity)	Impact Pathway	Effect (with Embedded and Standard Mitigation)	Mitigation Measure	Effect/Residual Effect	Confidence
3	Kings Road - between A1173 and Queens Road (Low)	Traffic flow	Minor	No additional mitigation	Minor (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.
4	Queens Road between Kings Road and Laporte Road (Medium)	Traffic flow	Minor	No additional mitigation	Minor (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.
5	Kings Road - between A1173/Kings Road and Kings Road/Pelham Road (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance
6	Manby Road - between A160/Manby Road and Kings Road/Pelham Road (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance

Link No.	Receptor (Sensitivity)	Impact Pathway	Effect (with Embedded and Standard Mitigation)	Mitigation Measure	Effect/Residual Effect	Confidence
7	A160 - Between Manby Road/A160 and A160/A1077 roundabout (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.
8	A160 - Between A160/A1077 roundabout and A160/A180 (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.
9	A180 West - between A180/A1173 and A180/A160 (Low)	Traffic flows	Negligible	No additional mitigation	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance
10	Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout (Low)	Traffic flows	Negligible	CTMP/CWTP	Negligible (Not significant)	Confidence level of significance prediction is high. Assessment based upon industry standard guidance.

11.14 References

Ref 11-1 Guidelines for the Environmental Assessment of Road Traffic. Institute of Environmental Assessment (1993).

Ref 11-2 National Planning Policy Framework. Ministry of Housing, Communities and Local Government (2021).

Ref 11-3 National Policy Statement for Ports. Department for Transport (2012).

Ref 11-4 Travel Plans, Transport Assessments and Statements – Planning Practice Guidance. Department for Communities and Local Government (2014).

Ref 11-5 Department for Transport Circular 01/2022 Strategic Road Network and the Delivery of Sustainable Development. Department for Transport (2022).

Ref 11-6 Design Manual for Road and Bridges, CD 123 Geometric design of at-grade priority and signal-controlled junctions. National Highways (2021).

Ref 11-7 North East Lincolnshire Local Plan 2013-2032 (adopted 2018). North East Lincolnshire Council (2018).

Ref 11-8 NOMIS, Census to Work Data WU03EW - Location of usual residence and place of work by method of travel to work (MSOA level).

Ref 11-9 Transport Assessment in support of the IERRT development. David Tucker Associates (2021).

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 12: Marine Transport and Navigation

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 12: Marine Transport and Navigation

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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12 Marine Transport and Navigation

12.1 Introduction

12.1.1 This chapter of the Environmental Statement ("ES") presents the baseline analysis and findings of the assessment of the likely significant effects of the Project on Marine Transport and Navigation.

12.1.2 As interrelationships exist with other assessments in relation to potential safety and commercial effects on marine transport and navigation, reference should be made to the following chapters of the ES **[TR030008/APP/6.2]**:

- **Chapter 22: Major Accidents and Disasters**
- **Chapter 23: Socio-Economics**

12.1.3 This chapter is supported by the following figures **[TR030008/APP/6.3]** and appendices **[TR030008/APP/6.4]**:

- **Figure 12.1:** General Overview of Humber Estuary
- **Figure 12.2:** Detailed Overview of Site
- **Figure 12.3:** Vessel Tracks by Type
- **Figure 12.4:** Vessel Tracks (Recreational)
- **Figure 12.5:** Vessel Densities
- **Appendix 12.A:** Navigational Risk Assessment ("NRA")
- **Appendix 12.B:** Ship Navigation Simulation Study

12.1.4 The marine transport and navigation assessment is supported by other topic chapters in the ES, including metocean data generated for the assessment reported in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

12.2 Consultation and Engagement

12.2.1 An Environmental Impact Assessment ("EIA") scoping exercise was undertaken in August 2022 to establish the form and nature of the marine transport and navigation assessment, and the approach and methods to be followed.

12.2.2 The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on marine transport and navigation. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

12.2.3 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

12.2.4 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

12.2.5 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.B [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 12-1**. The full responses to consultation comments are included within the **Consultation Report [TR030008/APP/5.1]**.

Table 12-1: Consultation Summary Table on Marine Transport and Navigation

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The main data sources from which information would be obtained to inform the current and future marine transportation and navigational baseline should be agreed with relevant consultation bodies, where possible.	Standard data sources on vessel activity and historical maritime incidents have been presented in **Section 12.6**. Stakeholder consultation has been carried out to verify and validate the baseline data, and discuss data gaps and limitations, e.g., small vessel activity.
		No details are provided on the assessment methodology to be used to determine likely significant effects, and this method should be clearly set out and justified based on evidence in the ES to demonstrate any conclusions reached.	**Section 12.4** describes the assessment methodology used in the NRA **[TR030008/APP/6.4]** and the ES **[TR030008/APP/6.2]**.
PEI Report (Statutory Consultation) January 2023	MCA	To address the ongoing safe operation of the marine interface during both the construction and operational phases of the project, the MCA would like to point the developers in the direction of the Port Marine Safety Code (PMSC) and its Guide to Good Practice. From the Guide to Good Practice, section 7 Conservancy, a Harbour Authority has a duty to conserve the harbour so that it is fit for use as a port. The harbour authority also has a duty of reasonable care to see that the harbour is in a fit condition for a vessel to be able to use it safely. Section 7.8 Regulating harbour works covers this in more detail.	The assessment work has been carried out in compliance with the Port Marine Safety Code ("PMSC") and its Guide to Good Practice ("GtGP"). The Port of Immingham as the Statutory Harbour Authority ("SHA") and Humber Estuary Services ("HES") as the Competent Harbour Authority ("CHA") are key stakeholders, along with external users of the Harbour.
		We note that during the formal safety risk assessment process undertaken as part of the Navigational Risk Assessment (NRA), more detailed and specific mitigation measures will be evaluated through the use of vessel simulations and consultation with stakeholders at a local hazard review workshop. The objective of the NRA will be to ensure all residual navigational risks are either broadly acceptable or tolerable with suitable risk controls in place. The NRA, when finalised will be appended to the ES. The MCA welcomes this approach.	Noted.

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	CLdN Ports Killingholme Limited	The consultation materials do not include a NRA, although we note you intend to do this in due course. We would draw your attention to the fact that the majority of the services calling at CLdN Ports Killingholme operated at fixed schedules. Construction vessel movements, construction zones and other construction operations should not interfere with the operation of scheduled services. This includes scheduled services taking priority over construction vessels, such as barges removing dredged material. Please inform us when you propose to undertake a full HAZID. We request that you provide information on navigational impacts and the NRA in due course.	An NRA has been undertaken for the Project and is contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]**. The NRA considers the consequences and impacts of the proposed Project on navigation, both during the construction and its consequent operation. The scope of the EIA includes the appraisal of new and existing vessel activity arising as a result of the construction of the new marine infrastructure. We note the references to concerns regarding impact on scheduling of existing services. Vessels moving to and from the Port of Immingham are managed by the Port of Immingham Statutory Harbour Authority and Humber Statutory Harbour Authority (operating as Humber Estuary Services, "HES"). Both authorities have a legal duty to carefully manage all marine movements to facilitate the safe and efficient functioning of the harbour areas. The marine scheduling activities for the Port of Immingham, and all other port facility harbour authorities on the Humber have to dovetail with the overarching marine scheduling role of HES. The process of arranging and managing shipping movements seeks to ensure the equitable use of available port infrastructure and revolves around the efficient timetabling and scheduling of vessel movements.
		We would expect to see information and assessment of the impacts of up to 400 new vessel movements per annum anticipated during the operational phase, giving consideration to the type/size of vessels calling at the Project, and whether any sailing speed restrictions will apply to other services sailing	Following the first Statutory Consultation, the jetty design was revised varying the two berth design to a single berth. Following this change in berth design the maximum forecast vessel arrivals for the jetty are now 292 vessels per annum of which up to 12 per year would be ammonia carriers. The

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		past the new berths, including extension eastwards of Immingham Oil Terminal of the existing 5 knot speed restrictions.	maximum forecast throughput for the jetty has been assumed as a reasonable worst case assumption for both the navigational risk assessment ("**NRA**") and for the environmental impact assessment ("**EIA**") which have been undertaken for the Project. A total of 27 simulation runs were conducted based on a two berth layout, but adapted to cover the most challenging manoeuvres for a single berth layout which was also being considered as an option at the time of the runs. Subsequent to completing the simulation study, the final Project design was reviewed by HR Wallingford and it was confirmed that the conclusions for the simulation (in respect of the layout option in line with the IOT) were applicable to the final design. The NRA is contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]**. We note that CldN participated in the workshops for the HAZID and NRA.
		We request that you provide information on navigational impacts and NRA in due course. We are able to provide responses to that prior to any application. We also request to participate in any HAZID workshops.	The Terminal would be able to accommodate vessels of length up to 250m and draught up to 14m. These vessels will require tugs for berthing, as well as line handling/mooring vessels as required. The assessments undertaken for the Project take into account the type and size of vessels calling at the new jetty. The effect of the Project on future marine traffic is assessed with regards to any additional identified hazards, embedded controls that are already in place on the Humber, and potential future control/mitigation measures in the NRA and in this chapter. Marine congestion is managed by Humber Vessel Traffic Service ("VTS") as part of the wider port movements planning / live traffic plan. The existing 5 knot

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			speed limit for Immingham Oil Terminal ("IOT") will be extended to the east to cover the Project berth. A maximum speed limit of 5 knots will apply to vessels passing the Project berth when a vessel is mooring, moored or unmooring (the same as at IOT). The statutory harbour authorities are together required to ensure the safety of navigation and marine operation and in accordance with the requirements of the Port Marine Safety Code, have a duty to review and approve current and proposed controls and processes to ensure that the safety of navigation is maintained. We note CldN's request to be involved in the NRA/HAZID workshops. The navigational assessments undertaken for the Project included a HAZID workshop and risk ranking process in which CLdN participated. The completed NRA is contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]** of this ES. The NRA reports on the workshop, which was undertaken and takes into account the comments within the Hazard Log, which informs the EIA which has been undertaken and is presented in this chapter.
	DFDS Seaways	The IERRT structure is omitted in every visual representation in the Project materials. The IERRT DCO may now be at the pre-application stage again, but the omission of the proposed structure misleadingly underplays the possibility of marine congestion in the area during both construction and operation should the two projects go ahead and the consequential safety risks in the vicinity of the jetty on the marine side of the Project.	The IERRT application is an entirely separate project, which is at the examination stage and is not yet consented. Consequently, there is no reason why it would need to be depicted visually on the application materials for the Project. The construction and operation of IERRT has been taken into account in the navigational risk assessment ("NRA") which has been undertaken for the Project. The NRA is

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]**. The cumulative effects of the Project with the proposed IERRT project have been assessed and is set out in **Chapter 25: Cumulative and In-Combination Effects** [**TR030008/APP/6.2**].
		The Project proposes to use the IMO's FSA methodology and PMSC to complete the NRA. The Project consultation materials describe this methodology as 'best practice' for port marine operations and the preferred approach of the MCA. This only serves to bolster our concern that using mixed methodologies in the IERRT proposals is a flawed approach, which we expressed in our response to the supplementary consultation to the IERRT. It is unclear why the Applicant would use different methodologies across these two projects and we suggest they reconsider their approach to IERRT.	The Project is a separate project to IERRT. However, both projects apply the same risk assessment approach which follows the Port Marine Safety Code and its associated Guide to Good Practice on Port Marine Operations. The methodology used for the assessment are set out this chapter.
		We have further concerns that marine navigation has not been considered cumulatively, in particular tug availability which is likely to be made more in demand by the Project. If tugs are not so readily available to service the vessel movements on the IERRT and the Project this will add to marine congestion and create delays in the vicinity.	The concerns expressed relating to tug availability are noted. As you know, marine navigational planning is a complex process requiring the review of multiple input scenarios to ensure that the passage of merchant vessels is afforded the most expeditious solution. The role of Vessel Traffic Services therefore is an integral part of that process. The provision of towage on the Humber is wholly driven by market forces and it is reasonable to assume – and indeed has been proven in the past – that should demand for additional towage become apparent, tug providers will increase vessel resourcing accordingly.

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			A 150m safety (exclusion) zone will apply to passing vessels from the berth line. The position of the berth has been aligned with IOT which also has a 150m exclusion zone, to ensure the channel width available to passing vessels is maintained. Simulations have been carried out to successfully demonstrate there is adequate space for passing vessels. This has been assessed within the NRA, including a HAZID Workshop attended by existing port users.
HAZID Workshop, carried out as part of the NRA May 2023	Various	Representatives from the Port of Immingham, Humber Estuary Services (HES), pilots, Svitzer, SMS Towage, HR Wallingford, Associated Petroleum Terminals (APT), Air Products and CLdN, provided input into the potential hazards, scenarios, causes, and controls (mitigation measures) for marine operations during the construction and operational phases of the project.	The completed NRA is included as **Appendix 12.A** to this ES **[TR030008/APP/6.4]**. This reports on the workshop and takes into account the comments within the Hazard Log, which informs the Impact Assessment presented in **Section 12.8**.
2nd Statutory Consultation June 2023	MCA	I can confirm that the MCA has no further comments in light of these changes to our original response as per attached. The site is within SHA limits, and they have responsibility for the safety of navigation within their waters during construction and the ongoing safe operation of the site. We note the intention to undertake a NRA for the proposals. The NRA should incorporate the final design and should be discussed and agreed with the SHA. The project should be carried out in accordance with the PMSC and its GtGP. The developers should work with the SHA to update the MSMS for the project in accordance with the code.	The SHA and CHA have been consulted and involved in the Project. All design changes and amendments have been discussed and approved by the SHA/CHA. The final design (as set out in **Chapter 2: The Project**) has been incorporated into the NRA; the assessment of the jetty design's impact on the safety of navigation aligns with the SHA's approach for managing navigational safety and meets the PMSC's requirement for assessing risk and maintaining the Marine Safety Management System ("MSMS"). The SHA's MSMS is internally audited on an annual basis, and an external assurance audit is undertaken every three years against the requirements of the PMSC and GtGP. The Applicant has stated compliance with the PMSC to the UK Government

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			and is listed on the .gov Port Marine Safety Code compliant ports webpage as a port submitting compliance, which is a requirement of the PMSC.
	CLdN	We made comments in reply to the PEIR consultation in relation to: 1. The approach to assessment of vessel calls, with only 12 of the potential 400 annual vessel calls being associated with other developments and uses which are not identified or assessed; 2. The absence of any navigation risk assessment or supporting information: and 3. A request to be involved in navigational risk assessments/HAZID workshops. We believe our comments in February response including in relation to uncertainty around future transport effects and sailing speed restrictions remain. We would also expect revised navigational risk assessment and HAZID to be undertaken.	1. Vessel calls Following the first Statutory Consultation, the jetty design was revised varying the two berth design to a single berth. Following this change in berth design the maximum forecast vessel arrivals for the jetty are now 292 vessels per annum of which up to 12 per year would be ammonia carriers. The maximum forecast throughput for the jetty has been assumed as a reasonable worst case assumption for both the navigational risk assessment ("NRA") and for the environmental impact assessment ("EIA") which have been undertaken for the Project. A total of 27 simulation runs were conducted based on a two berth layout, but adapted to cover the most challenging manoeuvres for a single berth layout which was also being considered as an option at the time of the runs. Subsequent to completing the simulation study, the final Project design was reviewed by HR Wallingford and it was confirmed that the conclusions for the simulation (in respect of the layout option in line with the IOT) were applicable to the final design. The NRA is contained within Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]. We note that CldN participated in the workshops for the HAZID and NRA. 2. Absence of NRA or supporting information

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			As explained above, an NRA has been undertaken for the Project and is contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]**. TheNRA considers the consequences and impacts of the proposed Project on navigation, both during the construction and its consequent operation. The scope of the EIA includes the appraisal of new and existing vessel activity arising as a result of the construction of the new marine infrastructure. We note the references to concerns regarding impact on scheduling of existing services. Vessels moving to and from the Port of Immingham are managed by the Port of Immingham Statutory Harbour Authority and Humber Statutory Harbour Authority (operating as Humber Estuary Services, "HES"). Both authorities have a legal duty to carefully manage all marine movements to facilitate the safe and efficient functioning of the harbour areas. The marine scheduling activities for the Port of Immingham, and all other port facility harbour authorities on the Humber have to dovetail with the overarching marine scheduling role of HES. The process of arranging and managing shipping movements seeks to ensure the equitable use of available port infrastructure and revolves around the efficient timetabling and scheduling of vessel movements. 3. Impacts from reduced sailing speeds in vicinity of the Project The Terminal would be able to accommodate vessels of length up to 250m and draught up to 14m. These vessels will require tugs for berthing, as well as line

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			handling/mooring vessels as required. The assessments undertaken for the Project take into account the type and size of vessels calling at the new jetty. The effect of the Project on future marine traffic is assessed with regards to any additional identified hazards, embedded controls that are already in place on the Humber, and potential future control/mitigation measures in the NRA and in this ES chapter. Marine congestion is managed by Humber Vessel Traffic Service ("VTS") as part of the wider port movements planning / live traffic plan. The existing 5 knot speed limit for Immingham Oil Terminal ("IOT") will be extended to the east to cover the Project berth. A maximum speed limit of 5 knots will apply to vessels passing the Project berth when a vessel is mooring, moored or unmooring (the same as at IOT). The statutory harbour authorities are together required to ensure the safety of navigation and marine operation and in accordance with the requirements of the Port Marine Safety Code, have a duty to review and approve current and proposed controls and processes to ensure that the safety of navigation is maintained. 4. NRA/HAZID workshops We note CldN's request to be involved in the NRA/HAZID workshops. The navigational assessments undertaken for the Project included a HAZID workshop and risk ranking process in which CLdN participated. The completed NRA is contained within **Appendix 12.A: Navigational Risk Assessment [TR030008/APP/6.4]** of this ES. The NRA reports on the workshop, which was

Reference / Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			undertaken and takes into account the comments within the Hazard Log, which informs the EIA which has been undertaken and is presented in this ES Chapter.
	DFDS Seaways	**Navigational Safety – methodologies** The IGET proposes to use the IMO FSA methodology and the PMSC to complete the NRA. The IGET consultation materials describe this methodology as 'best practice' for port marine operations and the preferred approach of the MCA. This only serves to bolster our concern that using mixed methodologies in the IERRT proposals is a flawed approach, which we expressed in our response to the supplementary consultation to the IERRT. It is unclear why the Applicant would use different methodologies across these two projects and we suggest they reconsider their approach to IERRT.	The Project is a separate project to IERRT. However, both projects apply the same risk assessment approach which follows the Port Marine Safety Code and its associated Guide to Good Practice on Port Marine Operations. The methodology used for the assessment is set out in this chapter.
		Marine navigation and congestion – exclusion zone We understand that facilities handling potentially hazardous products, such as IGET, may be required to operate an exclusion zone for vessels and other operations taking place in the vicinity. There is a reference within the topic "Marine Transport and Navigation" on page 29 on the Applicant's PEIR Addendum to "required safety zones" which we assume relates to such a requirement but cannot find any greater detail on this issue in the application documents. Depending on the extent and nature of any such "safety / exclusion zones" the operation of such zones may have a material impact on other operations taking place at the Port of Immingham and on vessel movements on the Humber. The Applicant should therefore provide a detailed assessment of any such "safety / exclusion zones" before its application is progressed any further so that interested parties and existing port users can assess and comment on any potential impact.	A 150m safety (exclusion) zone will apply to passing vessels from the berth line. The position of the berth has been aligned with IOT which also has a 150m exclusion zone, to ensure the channel width available to passing vessels is maintained. Simulations have been carried out to successfully demonstrate there is adequate space for passing vessels. This has been assessed within the NRA, including a HAZID Workshop attended by existing port users.

12.2.6 Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), no impacts were scoped out.

12.3 Legislation, Planning Policy and Guidance

12.3.1 **Table 12-2** presents the legislation, policy and guidance relevant to the Marine Transport and Navigation assessment and details how their requirements have been met in the assessment.

Table 12-2: Relevant legislation, policy and guidance regarding Marine Transport and Navigation

Legislation/Policy/Guidance	Consideration within the ES Report
Department for Transport ("DfT") Port Marine Safety Code, and relevant sections of the Guide to Good Practice (Ref 12-1)	
The Port Marine Safety Code sets out a national standard for every aspect of port marine safety. Its aim is to enhance safety for everyone who uses or works in the UK port marine environment. Although not mandatory, it is endorsed by the UK Government and representatives from across the maritime sector and, there is a strong expectation that all harbour authorities will comply. The Code is intended to be flexible enough that any size or type of harbour or marine facility will be able to apply its principles in a way that is appropriate and proportionate to local requirements.	The guidance on risk assessment has been adopted to ensure all marine risks are consulted upon and formally assessed so that they can be eliminated or reduced to ("ALARP") in accordance with good practice, and a MSMS implemented based on the risk assessment. This guidance has informed the identification of potential impacts and risks in **Section 12.8**.
International Maritime Organization's ("IMO") Revised Guidelines for Formal Safety Assessment (Ref 12-2)	
The Maritime Safety Committee, at its seventy-fourth session (30 May to 8 June 2001), and the Marine Environment Protection Committee, at its forty-seventh session (4 to 8 March 2002), approved the Guidelines for FSA for use in the IMO rule-making process. These have been amended several times with the latest being MSC-EPC.2/Circ.12/Rev.2, 9 April 2018	Provides a methodology for identifying and evaluating hazards/risks associated with marine operations, as well as appropriate mitigation measures, in a transparent and consistent manner. This guidance has informed the identification of potential impacts and risks in **Section 12.8**.
The Pilotage Act (Ref 12-3)	
The Pilotage Act requires CHAs to keep under consideration the pilotage services that may be required to secure the safety of ships. This Act gives a CHA the powers to make pilotage compulsory within their pilotage district and levy charges for the use of a pilot, grant pilotage exemption certificates and authorize pilots within their district. The Act also requires the Secretary of State to maintain a list of CHAs and	In line with the Act, in its capacity as CHA, HES has issued pilotage directions for the Humber. The pilotage requirements for vessels visiting the Humber, including the vessels that will visit the Project, have been considered within the assessment.

Legislation/Policy/Guidance	Consideration within the ES Report
empowers the Secretary of State to authorize other bodies to grant deep sea pilotage certificates in respect of such part of the sea falling outside the harbour of any CHA.	

12.4 Assessment Methodology

12.4.1 A formal assessment of marine transport and navigational hazards/risks has been undertaken within the NRA/ES in line with the Port Marine Safety Code (PMSC) (Ref 12-1) and the associated 'A Guide to Good Practice on Port Marine Operations' (**Table 12-4**), and the International Maritime Organization (IMO) Formal Safety Assessment (FSA) methodology (Ref 12-2). Further details can be found within the NRA (**Appendix 12.A [TR030008/APP/6.4]**).

12.4.2 Each hazard has been risk ranked in terms of consequence versus frequency using definitions for the Project agreed with ABP, as detailed in **Table 12-3** and **Table 12-4**, respectively. Consequences have been assessed according to the following four criteria:

a. People (human life)

b. Property (port and shipping infrastructure damage)

c. Planet (environment)

d. Port (reputation/business/amenity loss)

12.4.3 For each hazard scenario eight outcomes are therefore determined. This is comprised of four outcomes from the 'worst credible' description and four outcomes from the 'most likely' description for each receptor. These outcomes are identified from the frequency and consequence criteria determined post-HAZID. The outcome categories are assigned through the matrix shown in **Plate 12-1** and these categories are used to calculate risk as above.

Table 12-3: Severity of Consequence Ranking Definitions

Rank	Description	Definition			
		People	Property	Planet	Port (Business)
1	Negligible	No injury	Negligible (£0 - £10,000)	None (No incident - or a potential incident/near miss)	None
2	Minor	Minor injury(s)	Minor (£10,000 - £750,000)	No Measurable Impact (An incident or event occurred, but no discernible environmental impact - Tier 1 but no pollution control measures needed)	Minor (Little local publicity. Minor damage to reputation. Minor loss of revenue, £0 - £750,000)

Rank	Description	Definition			
		People	Property	Planet	Port (Business)
3	Moderate	Serious injury(s) (MAIB/RIDDOR reportable injury)	Moderate (£750,000 - £4M)	Minor (Incident results in pollution with limited/local impact - Tier 1, Harbour Authority pollution control measures deployed)	Moderate (Negative local publicity. Moderate damage to reputation. Moderate loss of revenue, £750,000 - £4M)
4	Major	Single fatality	Serious (£4M - £8M)	Significant (Has the potential to cause significant damage and impact - Tier 2, pollution control measures from external organisations required)	Serious (Negative national publicity. Serious damage to reputation. Serious loss of revenue, £4M - £8M)
5	Extreme	Multiple fatalities	Major (> £8M)	Major (Potential to cause catastrophic and/or widespread damage - Tier 3, requires major external assistance)	Major (Negative national and international publicity. Major damage to reputation. Major loss of revenue, > £8 M)

Table 12-4: Frequency of Occurrence Ranking Definitions

Rank	Description	Definition	Indicative Return Period
1	Rare	The impact of the hazard is realized but should very rarely occur (within the lifetime of the entity)	> 1,000 years
2	Unlikely	The impact of the hazard might occur but is unlikely (within the lifetime of the entity)	100 – 1000 years
3	Possible	The impact of the hazard could very well occur, *but it also may not* (within the lifetime of the entity)	10 – 100 years
4	Likely	It is quite likely that the impact of the hazard will occur (within the lifetime of the entity)	1 – 10 years

Rank	Description	Definition	Indicative Return Period
5	Almost Certain	The impact of the hazard will occur (within lifetime of entity)	< 1 year

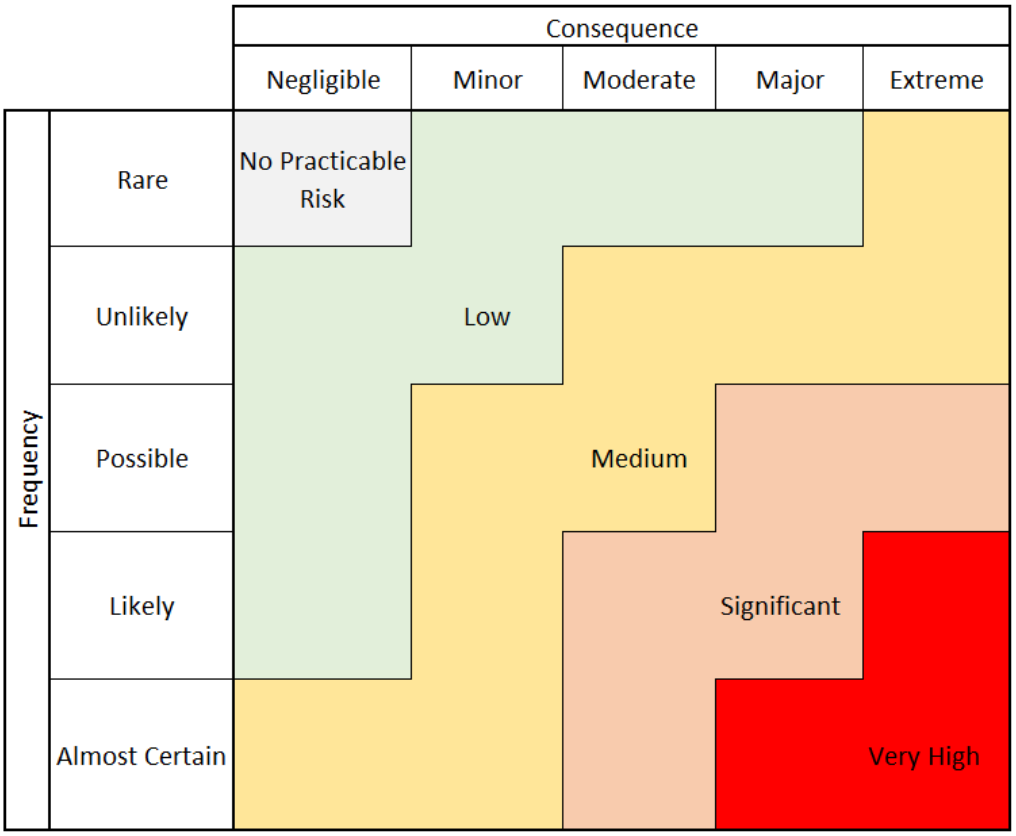
12.4.4 Hazard scenarios were assessed in terms of both most likely and worst credible outcomes, to reflect the range of potential outcomes arising from an incident.

12.4.5 For each hazard, embedded mitigation in the form of existing safety measures in place at the Port, or planned for the Project, were documented and taken into account within the risk rankings.

12.4.6 The assessment was informed by a HAZID workshop involving marine risk specialists, Project and Port personnel, and Port users.

12.4.7 The overall risk ranking (frequency vs. consequence) determined the hazard's position within the risk matrix shown in **Plate 12-1**.

Plate 12-1: Risk Matrix



12.4.8 The outcome of the risk assessment was compared with ABP's risk tolerability criteria for each of the four receptors, and formally approved at a meeting of the ABP Harbour Authority Safety Board ("HASB") (see NRA, **Appendix 12.A [TR030008/APP/6.4]**). In the context of marine safety, the overriding objective identified in the PMSC is to reduce risk to a point which is ALARP. Therefore, if a risk is intolerable, it is imperative that controls are applied until the risk is both ALARP and tolerable.

12.4.9 For the purposes of this assessment, impacts that are deemed to be intolerable, or not within ALARP parameters, are considered to be significant in EIA terms; impacts deemed to be tolerable and ALARP are deemed as not significant in EIA terms.

Data and Information Sources

12.4.10 Current baseline conditions have been determined by a desk-based review of available information. The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the Project include:

a. Automatic Identification System (AIS) data
b. Marine accident/incident data
c. Information from Admiralty charts and publications
d. Information from ABP Humber publications

Automatic Identification System ("AIS") data

12.4.11 Up to date AIS vessel tracking data has been used to characterise baseline marine traffic. The full dataset is comprised of the 12 months from 1 September 2021 to 31 August 2022, to cover seasonal variations. There was a small amount of downtime noted over the 12 months of approximately 3%; numbers have been scaled up to account for this where appropriate.

12.4.12 AIS equipment (Class A) is required to be fitted on all vessels of 300 gross tonnage (GT) and upwards engaged on international voyages, cargo vessels of 500GT and upwards not engaged on international voyages, passenger vessels irrespective of size, built on or after 1 July 2002, and fishing vessels of 15m length and above. Smaller vessels (e.g., fishing vessels less than 15m in length and recreational craft) are not required to broadcast on AIS, but may do so voluntarily typically using Class B units. Both Class A and B vessels are included in the AIS dataset that has been used.

12.4.13 The AIS data have been analysed and divided into the following vessel categories:

a. Port service craft (e.g., pilot vessels, port tenders etc)
b. Vessels engaged in dredging or underwater operations
c. Tugs
d. Offshore support vessels (e.g., wind farm, oil and gas)

e. Passenger vessels

f. Cargo vessels (e.g., general cargo vessels, ro-ro cargo vessels and bulk carriers etc)

g. Tankers (e.g., oil tankers, chemical tankers, and gas carriers)

h. Fishing

i. Recreational

j. Unspecified/Other (e.g., military, patrol boats, survey vessels, lifeboats, etc)

Maritime accidents/incidents

12.4.14 To characterise maritime incidents occurring within the study area, available data have been analysed from the following three sources using consistent time periods:

a. ABP Humber MarNIS (Port Risk Management software) incident data: complete dataset from 2012 to 2021 inclusive.

b. Royal National Lifeboat Institution ("RNLI"): complete dataset of all callouts from 2012 to 2021 inclusive.

c. Marine Accident Investigation Branch ("MAIB"): complete dataset from 2012 to 2021 inclusive.

Admiralty Charts and Sailing Directions

12.4.15 Navigational features have been considered in this assessment and have been identified using information from UK Hydrographic Office ("UKHO") Admiralty Charts 104, 3497 and 1188. These charts are used by mariners as part of the passage planning process and to plot progress during a passage and so contain all relevant navigational information. More details can be found in the Admiralty Sailing Directions NP54 (12th edition 2021) issued by UKHO (Ref 12-5).

Vessel Simulations

12.4.16 Vessel simulations were carried out at HR Wallingford's UK Ship Simulation Centre over three days between 11 and 13 April 2023, attended by port personnel and external stakeholders. A total of 27 simulation runs were conducted based on a two berth layout, but adapted as far as possible to cover the most challenging manoeuvres for a single berth layout which had been decided prior to the runs.

12.4.17 Two layouts were modelled: Layout 1 based on a 150m exclusion zone aligned with IOT, and Layout 5 with an additional setback to allow a 250m exclusion zone. Layout 5 was prioritised as the most challenging, however Layout 1 was also tested, which matches the alignment of the final berth design. Subsequent to completing the study, the final design was reviewed by HR Wallingford and it was confirmed that the conclusions with respect to Layout 1 were applicable to the final design.

12.4.18 Overall, the simulation runs did not raise any major problems or causes for concern for vessels arriving or departing the Project, or the neighbouring IOT jetties. For passing traffic, it was demonstrated that vessels will be able to pass safely to the north of the Project based on existing protocols. The simulation results were considered within the risk assessment. Full details of the vessel simulations are provided within **Appendix 12.B [TR030008/APP/6.4]**.

Limitations and Assumptions

12.4.19 This assessment has been undertaken based on the Project design and project methodology, as detailed in **Chapter 2: The Project** and **Chapter 3: Need and Alternatives** of the ES **[TR030008/APP/6.2]** and any relevant constraints identified in **Chapter 22: Major Accidents and Disasters of the ES [TR030008/APP/6.2]**.

12.4.20 The AIS vessel tracking data used in the baseline assessment does not fully cover all vessel movements, such as smaller fishing vessels and recreational vessels that are not required to broadcast on AIS. This has been consulted upon with Port personnel and identified to be a small fraction of the overall traffic. This has been taken into account within the risk assessment.

12.5 Study Area

12.5.1 For this assessment, the study area covers all the area over which potential direct and indirect consequences of the Project are predicted to arise during the construction and operational periods.

12.5.2 The study area has been defined as the area comprising the Humber Estuary bounded on the west by the Humber Bridge and on the east by the Humber Estuary Services Statutory Harbour Authority (“SHA”) limit for the Humber Estuary. This study area encompasses the marine works associated with the Project, the main route to and from the Project location, and considers the total utilisation of the Humber Estuary to determine the implications on vessel traffic management.

12.5.3 **Figure 12.1 [TR030008/APP/6.3]** gives an overview of the study area.

12.5.4 **Figure 12.2 [TR030008/APP/6.3]** gives a zoomed-in view of the Site Boundary and key surrounding features.

12.5.5 The Site Boundary extends approximately 0.6nm from the southern side of the Humber.

12.6 Navigational Baseline Conditions

Current Baseline

12.6.1 The following sections review the baseline information for marine traffic and transport within the study area. The following elements are covered in the baseline:

a. Statutory responsibilities and management procedures

b. Visual aids to navigation

c. Vessel services

d. Vessel traffic management

e. Marine traffic analysis

f. Marine accidents and incidents

Statutory responsibilities and management procedures

12.6.2 The Project, if consented, will be located fully within an extended Port of Immingham SHA area where the Applicant is the SHA. In this capacity, the Applicant is responsible with a set of powers and duties which include the management and regulation of the safety of navigation and marine operations in its SHA area.

12.6.3 HES also run by ABP but as a separate statutory function, is the SHA for the wider Humber Estuary and CHA with respect to pilotage for the Humber Estuary and the ABP docks and other port facilities within the wider Estuary. As the CHA, HES has the power to issue Pilotage Directions that prescribe which vessels require a Pilot or Pilot Exemption Certificate ("PEC") holder when navigating within the CHA area.

12.6.4 VTS is provided for the Humber Estuary in line with the guidance as laid out in MCA MGN 401 (Amendment 3) (Ref 12-8), and is formally identified with a VTS designation within Merchant Shipping Notice ("*MSN") 1796 (Amendment 2) Vessel Traffic Services (VTS) - Designation of VTS Stations in the United Kingdom* for the benefit of the compliance with regulations 6 and 7 of the Merchant Shipping (Vessel Traffic Monitoring and Reporting Requirements) Regulations 2004 (Ref 12-9). Humber VTS maintains a vessel traffic picture through the AIS and Radar providing information on weather, vessel movements and marine safety to vessels navigating in the VTS area. All sea-going vessels are required to report to Humber VTS when entering and leaving the VTS area and at designated reporting points identified on navigational charts.

12.6.5 The Applicant is also the Local Lighthouse Authority ("LLA") for the Port of Immingham's SHA area by virtue of the Merchant Shipping Act 1995. As LLA, the Applicant is responsible for the provision and maintenance of Aids to Navigation ("AtoN"). The Applicant is required to report any defects to AtoN and consult on any proposed changes, additions or removal of AtoN with Trinity House Lighthouse Authority as the General Lighthouse Authority for England and Wales.

12.6.6 Both the Port of Immingham and HES have committed to meeting the requirements of the PMSC. The PMSC requires that ports operate a MSMS which is based on a comprehensive and a continuously updated set of risk assessments. The MSMS details how the ports fulfil their duties as SHAs and meet the marine safety requirements prescribed by the PMSC.

Visual Aids to Navigation

12.6.7 Visual aids to navigation within the study area conform to the standards of the International Association of Marine Aids to Navigation and Lighthouse Authorities ("IALA") and Trinity House.

12.6.8 Lateral markers are used to denote the navigable section of the estuary, the main navigable channel, and smaller channel, Foul Holme Channel. Leading lights are positioned on the Immingham Bulk Terminal identifying the main channel for transiting vessels.

12.6.9 A number of aids to navigation are surrounding the facilities nearby which include channel lights denoting the terminals and edge of the channel particularly noticeable on the Oil Terminal and Immingham Bulk Terminal.

Vessel Services

12.6.10 Pilotage in the Humber Estuary and the Port of Immingham is provided by HES. Pilotage Directions define the Humber Pilotage Area and the requirements for compulsory pilotage within it (Ref 12-6). The directions also lay down requirements under which PECs are issued and administered in the area.

12.6.11 Vessels subject to compulsory pilotage within the compulsory pilotage area include:

a. All vessels of greater than 60m length.

b. Any vessel less than 60m carrying a bulk cargo of dangerous substances as defined and categorised in the Dangerous Substances in Harbour Areas Regulations (Ref 12-7).

c. Vessels over 100 m moving between tidal estuary berths which includes the moving of mooring lines.

12.6.12 Towage is provided by a range of service providers with the main companies being SMS Towage and Svitzer who offer a range of tugs with different bollard pull capacities.

12.6.13 The vessel's size, type and draught dictate the minimum tugs that are required. Of particular note for the study area, all tankers visiting Immingham Oil Terminal ("IOT") up to 150,000 Dead Weight Tonnage ("DWT") and gas tankers over 20,000 DWT require two tugs from the Sunk Spit Buoy for the passage to the berth.

12.6.14 Tankers up to 50,000 DWT require three tugs for berthing, four tugs are required for berthing tankers 50,000 to 150,000 DWT and five for any vessels greater than 150,000 DWT.

12.6.15 Vessels visiting the IOT Finger Pier are accompanied by the tug which is on standby at the pier.

Vessel Traffic Management

12.6.16 A VTS, which is located at the Humber Marine Control Centre ("HMCC") in Grimsby, operates a 24-hour service for all river users. The objectives of VTS are safe use of the waterway, efficiency of traffic movement, and protection of the marine and adjacent environment. The system is compulsory for all sea-going vessels when entering the Humber VTS area.

12.6.17 The service provides AIS coverage throughout the VTS area and radar tracking within the area bounded by the Humber Bridge and the seaward limits of the VTS area. In addition, every two hours the VTS service broadcasts information to mariners regarding the weather, tidal information and navigational warnings.

DfT Port Statistics

12.6.18 Statistics published by the DfT indicate that the Humber Estuary is one of the busiest waterways in the UK with the main Humber Ports of Hull, Goole, Grimsby and Immingham accounting for the majority of cargo handled on the River Humber. Grimsby and Immingham handled just over 50 million tonnes of freight cargo in 2021, second only to London in the UK. The Port of Hull handles nearly 10 million tonnes of cargo per year and Goole around 2 million tonnes.

Marine Traffic Analysis

12.6.19 This section presents an analysis of all vessels, based on 12 months of AIS data for the period 1 September 2021 – 31 August 2022, intersecting a gate drawn across the river perpendicular to the Site Boundary. More detailed traffic analysis is presented in the NRA (**Appendix 12.A [TR030008/APP/6.4]**).

12.6.20 Tracks intersecting the gate were analysed using Anatec's *AIS Time Analyser* program. This calculated the time and direction of passage at the point at which vessels crossed the gate. This program analyses each individual track intersection, and therefore, vessels making more than one transit in a single day have been counted on each transit.

12.6.21 **Figure 12.3 [TR030008/APP/6.3]** shows the AIS vessel tracks intersecting the gate for a typical month, colour-coded by vessel type.

12.6.22 It can be seen that the Site Boundary is in a stretch of the river which is transited by a range of vessels including port service craft (e.g., pilot boats), tankers, tugs and vessels engaged in dredging or underwater operations. The vessels recorded crossing the Site Boundary were mostly tugs of smaller lengths (less than 60 m), used to assist tankers and cargo vessels for manoeuvring in the area.

12.6.23 There were several types of tankers recorded in the study area. These included tank barges, oil/chemical tankers, product tankers, Liquified Petroleum Gas ("LPG") carriers. Tank barges and product tankers were recorded transiting to IOT Finger Berth, LPG carriers were recorded transiting to South Killingholme Jetty and Immingham Gas Terminal, oil/chemical tankers were observed near Western Jetty, IOT and within Immingham Dock.

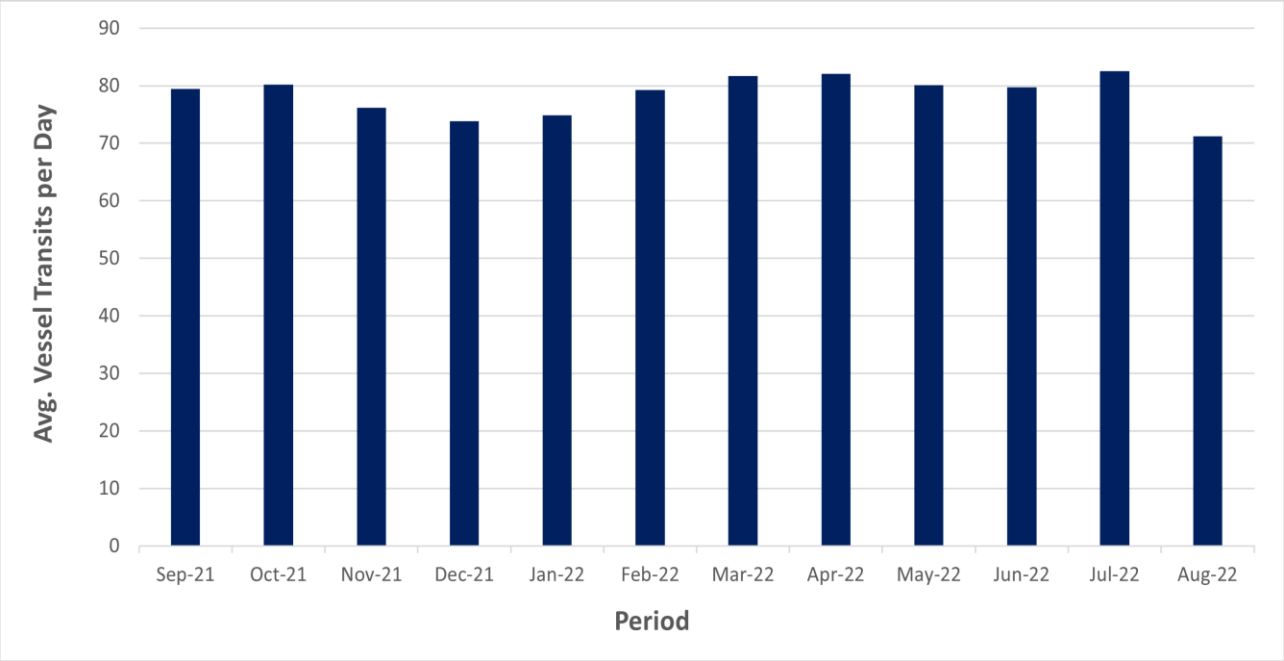
12.6.24 The majority of the cargo vessels (i.e., bulk carriers, container carriers, general cargo, and ro-ro cargo carriers), were recorded transiting to Immingham Outer Harbour and Humber Sea Terminal, with some using the Foul Holme Channel to transit to Hull.

12.6.25 Passenger vessels comprised of ferries from Hull to Rotterdam and Killingholme to Netherlands. Vessels involved in dredging/underwater operations were most prominent in River Humber adjacent to the West Jetty and HIT. Offshore support vessels were mostly crew transfer boats transiting to Humber Gateway Wind Farm.

12.6.26 Among port service crafts, research vessels were recorded transiting the Site Boundary, Immingham Dock and Humber International Terminal ("HIT"), and pilot vessels were mostly observed transiting north of the Site Boundary.

12.6.27 **Plate 12-2** presents the average vessel transits per month intersecting the gate during the study period.

Plate 12-2: Monthly Vessel Transits (12 Months)



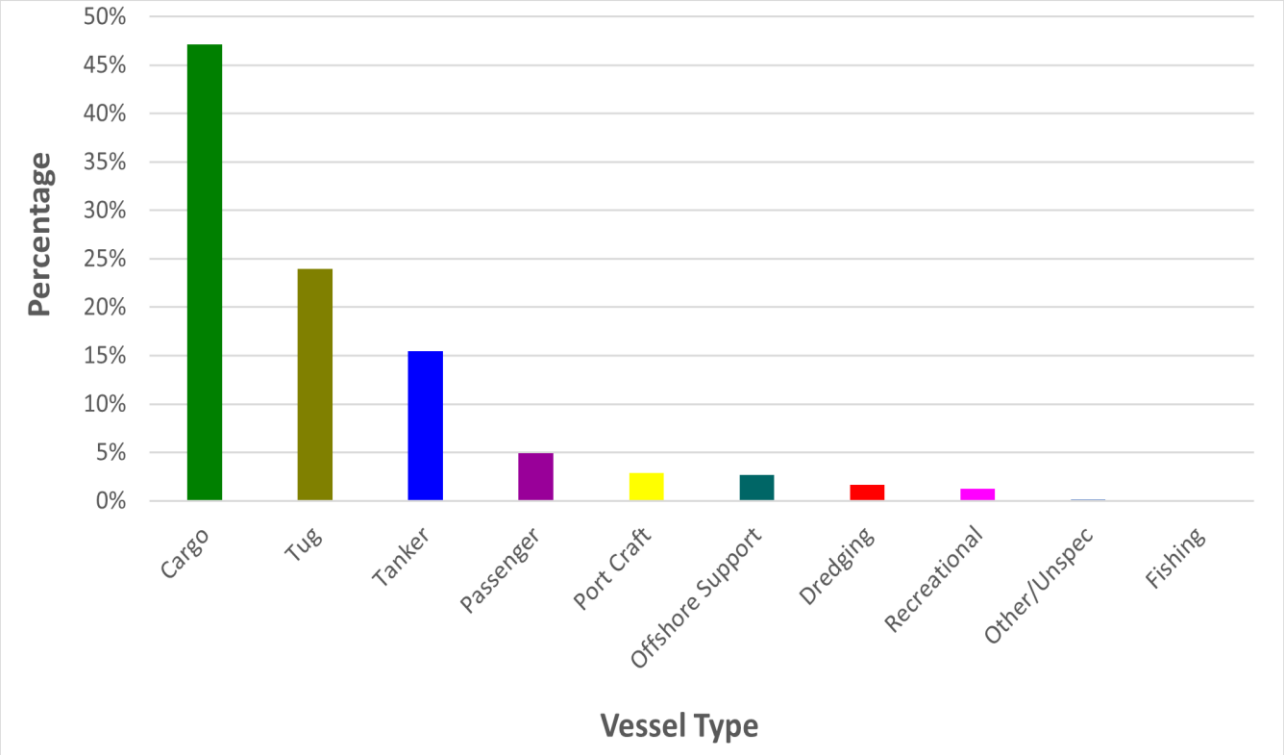
12.6.28 An average of 78 vessel transits per day crossed the gate during the 12-month study period[1]. The busiest months were March, April and July 2022 with an average of 82 transits per day each month. August 2022 was the least busy with an average of 71 transits per day.

12.6.29 An average of ten vessel transits per day were recorded crossing the Project structure including the 150m exclusion zone.

12.6.30 **Plate 12-3** shows the distribution of vessels recorded crossing the gate by type during the 12-month period.

[1] If each unique vessel is only counted once per day crossing the gate, the average unique vessel crossings per day is 56.

Plate 12-3: Vessel Type Distribution Crossing Gate (12 Months)



12.6.31 The most common vessel types recorded crossing the gate were cargo vessels (47%), followed by tugs (24%), tankers (15%) and passenger vessels (5%). Port service crafts and offshore support vessels each accounted for 3%, while recreational vessel transits accounted for 1% of the distribution. Other/unspecified and fishing vessels contributed less than 1% of the overall vessel type distribution. The vessel movements for each type representing over 1% of the total traffic during the 12-month study period have been discussed in the NRA (**Appendix 12.A [TR030008/APP/6.4]**).

12.6.32 The most common vessel types recorded crossing the Project infrastructure, including the 150 m exclusion zone, were tugs (69%), followed by tankers (16%), cargo vessels (8%) and port service crafts (5%). Only smaller vessels crossed south of the berth, with larger vessels tending to pass through the northern edge of the exclusion zone.

12.6.33 It is reiterated that small fishing vessels (below 15m in length) and recreational craft may be under-represented by the AIS data due to carriage requirements.

Recreational Navigation

12.6.34 The Humber Estuary has approximately 1,000 permanent berths and 120 visitor berths for recreational craft. The majority of recreational activity occurs during the summer months and predominantly on the weekend. There are no recreational facilities based at the Port of Immingham.

12.6.35 Established recreational vessel destinations in the Humber Estuary include: Hull Marina which has accommodation for 310 boats and 20 visitors; Goole Boathouse which offers 140 moorings and South Ferriby marina which provides accommodation for 100 boats plus 20 visiting vessels. In addition, there are various creeks around the estuary providing further capacity, namely Tetney Haven (Humber Mouth Yacht Club) where small numbers of moorings are available, Stone Creek (located on the north side of the river opposite Immingham), Hessle Haven and Barrow Haven, which both provide anchorages.

12.6.36 During the 12-month AIS study period, recreational activity peaked in July and August, with two vessel transits per day on average, during each month. In winter, there was an average of less than one vessel per week. **Figure 12.4 [TR030008/APP/6.3]** shows the 12 months of recreational vessel tracks recorded on AIS.

Vessel Densities

12.6.37 This section presents a vessel density plot (heat map) based on the year of AIS tracks intersecting a grid of cells encompassing the Project.

12.6.38 The density grid for the 12-month AIS dataset is presented **in Figure 12.5 [TR030008/APP/6.3]**. It represents a vessel density heat map based upon the number of AIS tracks intersecting 100m x 100m grid cells.

12.6.39 A high-density route was observed through the main channel, crossing the northern (outer) edge of the Site Boundary used by vessels transiting to / from Immingham, as well as the Foul Holme channel. The inner (southern) part of the Site Boundary had limited traffic due to the shallow water depths and presence of the nearby IOT infrastructure.

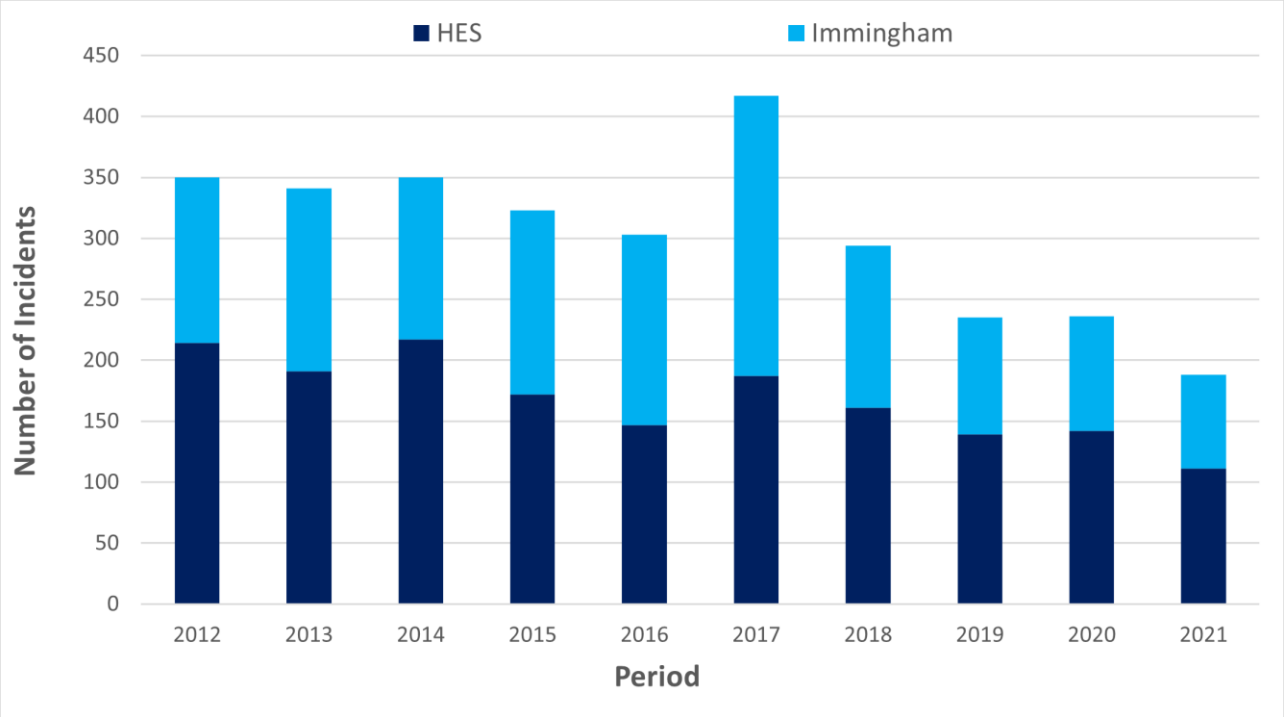
Historical Maritime Incidents

12.6.40 This section presents a summary of the maritime incidents within the study area over a ten-year period, based on three sources; MarNIS (ABP Humber), RNLI, and MAIB. A more in-depth analysis has been undertaken in the NRA (**Appendix 12.A [TR030008/APP/6.4]**.

MarNIS (2012 to 2021 inclusive)

12.6.41 **Plate 12-4** shows a summary of yearly fluctuations within the study area, based on the MarNIS data.

Plate 12-4: Number of Incidents based on MarNIS Data



12.6.42 An average of 304 incidents per year were recorded by the MarNIS. The overall trend is downwards although not in a straight-line, for example, there was an increase in 2017 due to pilot ladder defects and weighted heaving lines being a focus area for the port, resulting in increased reports.

12.6.43 The most common incident reported for both HES and Immingham was equipment failure in vessels, 54% and 41% respectively. The next most common was impact with port infrastructure.

12.6.44 It is noted that the number of incidents recorded in MarNIS is much higher than the other sources due to reporting requirements, including near misses being logged.

12.6.45 **Table 12-5** summarises the seven MArNIS incidents recorded in the past 10 years within the marine boundary of the Project.

Table 12-5: Incidents within the marine boundary of the Project

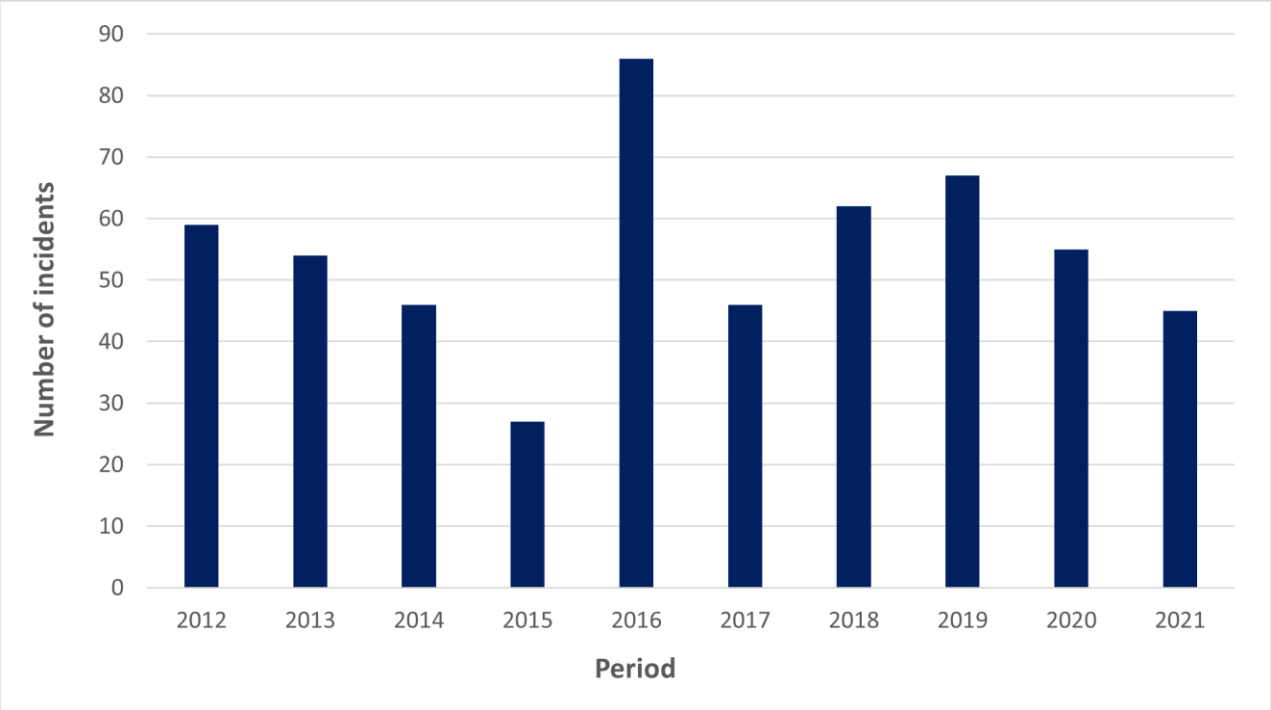
ID	Date	Category of Incident
1	24/05/2013	Grounding
2	23/10/2013	Suspicious floating object
3	24/02/2017	Damaged cargo
4	26/04/2018	Equipment failure (vessel)
5	19/06/2020	Equipment failure (vessel)

ID	Date	Category of Incident
6	01/04/2021	Striking with ship (moored)
7	20/07/2021	Equipment failure (vessel)

RNLI (2012 to 2021 inclusive)

12.6.46 **Plate 12-5** shows a summary of yearly fluctuations within the study area, based on RNLI data.

Plate 12-5: Number of Incidents based on RNLI Data

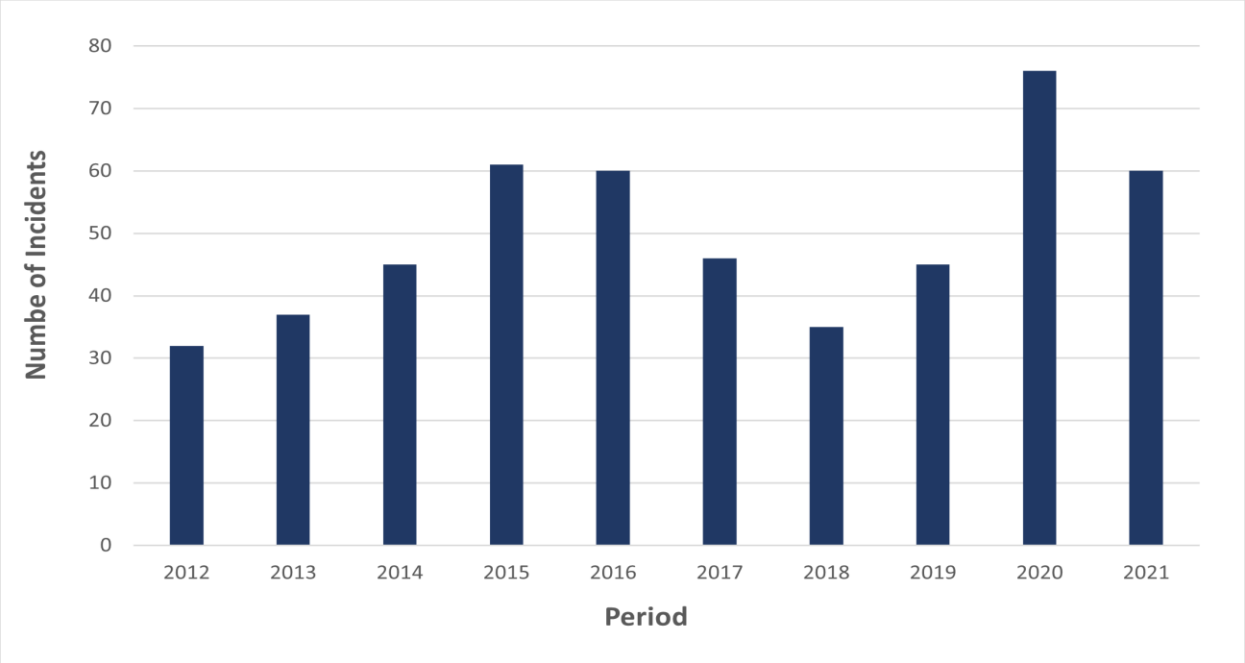


12.6.47 An average of 55 incidents per year were recorded by the RNLI. Most of the recorded incidents were due to equipment failure, grounding, sailing failure (recreational activity) and collision. The incidents that were recorded in proximity to the Project were responded to by the Humber Lifeboat Station. The Cleethorpes station was also involved in responses to incidents farther east, near Grimsby.

MAIB (2012 to 2021 inclusive)

12.6.48 **Plate 12-6** shows a summary of yearly fluctuations within the study area, based on the MAIB data.

Plate 12-6: Number of Incidents based on MAIB Data



12.6.49 An average of 50 incidents per year were recorded by the MAIB. Most of the recorded incidents were due to grounding, equipment failure, collision with port infrastructure and loss of control.

Future Baseline

12.6.50 General economic growth over the assumed 50-year lifetime of the Project (giving the greatest potential for changes to traffic levels), as well as increased vessel traffic due to specific developments, could increase the number of vessel movements to and from the Humber (and in particular, Immingham). This has been assessed in the NRA (**Appendix 12.A [TR030008/APP/6.4]**), noting that the Port has spare capacity relative to historical peaks in vessel arrivals.

12.6.51 Cumulative impacts on commercial and recreational navigation could arise as a result of other coastal and marine developments and activities in the Humber Estuary. These are considered as part of the cumulative impacts and in-combination effects assessment in **Chapter 25: Cumulative and In-Combination Effects** of the ES **[TR030008/APP/6.2]**.

12.7 Development Design and Impact Avoidance

Mitigation Measures

12.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to marine transport and navigation through the process of design development, and by embedding mitigation measures into the design.

12.7.2 Embedded mitigation also includes controls which are already active and applied by the Harbour Authority within the Port of Immingham or by HES in relation to marine operations in the study area.

12.7.3 Mitigation measures proposed at the HAZID workshop have also been adopted by the Project, such as to revise and extend existing controls where necessary, such as port plans and procedures.

12.7.4 **Table 12-6** provides a list of the mitigation measures.

Table 12-6: List of Mitigation Measures (Risk Controls)

ID	Control	Description
1	Updated port controls, plans and procedures	Existing port documents including the Port Marine Safety Management System (MSMS), Humber Passage Plan (HPP), and Humber Emergency Plan (HEP), will be updated to take into account the Project.
2	Updated Admiralty publications	Information about the Project will be provided to UKHO in a timely manner to allow Charts, Sailing Directions, and Admiralty List of Radio Signal (ALRS), to be updated.
3	Pilotage / PEC	Gas carriers to the Project will be subject to HES pilotage requirements. A significant proportion of vessels passing the Project will also be subject to Pilotage requirements or have Pilotage Exemption Certificate (PEC) holders onboard.
4	Towage	Towage support in terms of the number and power of tugs appropriate to the size of the gas carrier and weather conditions will be provided by tugs from the Sunk Spit Buoy for the passage to the berth, as well as assisting departure. General availability of towage will also help provide assistance in the event of a mooring breakout.
5	VTS	Adherence of vessels to Humber Vessel Traffic Services requirements and instructions. Humber VTS will help control vessel movements and avoid dangerous encounter situations, e.g., involving construction vessels.
6	Aids to Navigation (AtoNs)	The marine works shall be appropriately lit as soon as there are items which pose a hazard to navigation. Once operational, aids to navigation shall be provided and maintained so that the structure and berth can be identified. The safe navigation of all vessels in the Humber is aided by numerous existing AtoNs.
7	AIS Equipment	The vast majority of vessels using the Humber broadcast on AIS and therefore can be tracked by other vessels for collision avoidance, as well as by the VTS. The majority of Project vessels, including gas carriers and construction barges, will broadcast on AIS.
8	Passage Planning	Project vessels will have in place appropriate passage plans as well as adhering to the Humber Passage Plan when applicable.
9	Traffic Management	Vessels will be sequenced as per the Humber Passage Plan to help avoid encounters and prevent overtaking, e.g., an IOT vessel will be brought in ahead of the Project vessel to allow both to be berthed at High Water.
10	COLREGS	Vessels will adhere to the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS).

ID	Control	Description
11	Availability of secondary channel	There is a secondary channel (Foul Holme) that can be used by certain vessels within a set tidal range.
12	Circulation of Information	Information will be circulated about the Project to users of the Humber via Notices to Mariners and river warnings broadcast by the VTS every 2 hrs (or more frequently if required) which consist of maritime safety information, and designated no-go zones. Temporary construction information not on Admiralty charts could be marked by other means, e.g., Portable Pilot Unit (PPU).
13	Stakeholder liaison	Stakeholder engagement and liaison will be held with recreational and fishing representatives to make them aware of the Project and related vessel activities during the different phases.
14	Communications between Project/Port	Discussion of upcoming activities shall take place with the personnel at Immingham, HES and where relevant, the Pilots and IOT.
15	Hydrographic surveys	The current programme of surveying at the Port of Immingham shall be updated to include the Project. The results of the survey shall be provided to the UKHO for use in navigational charts and compared with previous surveys to inform potential requirements for maintenance dredging.
16	Weather limits	The maximum weather limits for operations shall be assessed and set for all activities. These shall be monitored against real time and forecasted weather conditions throughout the construction process. In addition, operational weather limits shall also be considered for vessels using the terminal during the operational phase.
17	Weather monitoring	Weather forecasting and monitoring shall be carried out and compared with the allowable weather limits for reliable planning and assessment of risk regarding the weather operating limits, which will vary between phases and activities, e.g., construction vs. normal operation.
18	Tidal Limits	Tidal limits will apply to certain activities (analogous to weather limits).
19	Speed limits	A maximum speed limit of 5 knots will apply to vessels passing the Project berth when a vessel is mooring, moored or unmooring. (the same as at IOT). VTS will monitor for unsafe speeds, including during construction work. Sanctions may be used against repeat offenders, e.g., removal of PEC.
20	Berth design	The Project berth will be aligned with IOT (including the exclusion zone) to maintain the width of the channel to the north (noting most vessels already avoid the planned exclusion zone).
21	Simulations	A real-time ship navigation simulation study has been carried out to demonstrate vessels can navigate safely to/from the Project facility, and that adverse effects are not imposed on other Port users. Further simulations to be carried out, if identified to be necessary, to inform detailed operational requirements.

ID	Control	Description
22	Safety zone	A minimum 150m exclusion zone will apply to passing vessels from the berth line. A suitable construction safety zone will also be designated.
23	Fendering / bollard design	These will be designed to be fit for purpose, and suitable to accommodate range of vessels using berth.
24	Shoreside maintenance program	A regular program of maintenance for infrastructure including mooring bollards/hooks, shall be implemented to ensure that the facility is maintained and fit for use.
25	Mooring study and plans	A mooring study shall be completed for the proposed mooring arrangements at the berth to confirm that there are appropriate moorings available to moor vessels for the operational wind limits and the expected tidal flows.
26	Load monitoring	Monitoring will be in place to detect any ranging of a berthed vessel prior to a potential breakout. Prior consultation with the jetty will be required before a vessel adjusts its mooring.
27	Gas carrier design standards and industry guidance	These vessels have a range of inherent safety features as well as industry guidance which help to prevent or mitigate incidents, such as a potential release.
28	CCTV	CCTV will be used to monitor the jetty area.
29	Minimising personnel exposure	Measures to minimise exposure in the event of release of a toxic substance, e.g., ammonia, will be considered, e.g., remote jetty operations and toxic refuges.
30	Emergency plans, exercises and response resources	These will be in place, as appropriate, for each phase. For example, construction contractors shall have tier 1 oil spill response equipment to ensure any pollution events can be contained.
31	Harbours Works Consent	This is consent required from HES before any construction activity can commence. This will follow on from a contractor approval process.
32	Contractor RAMS and SMS	Contractors shall have Risk Assessment Method Statement (RAMS) and Safety Management System (SMS) covering all of the construction activities which shall be reviewed by the Harbour Authority prior to the commencement of activities.
33	CDM Regulations	The Construction (Design and Management) Regulations 2015 will be adhered to, to help protect employee health during construction projects.
34	Standard Operating Procedures (SOP)	Suitable procedures will be in place during construction work
35	Vessel Checks	Checks will be carried out to make sure construction vessels are fit for purpose.

ID	Control	Description
36	Non-Routine Towage (NRT) Assessments	These will be carried out when necessary to assess the risks and establish requirements, e.g., if pilotage is required, number of tugs, radius of towage, tidal restrictions, etc. Covered in HES Towage Guidelines.
37	Designated Point of Contact	During construction activities, there will be a designated PoC to provide appropriate information and respond to emergency situations. This role shall be the main line of communication between the works and the SHA.
38	Safety Vessel	A safety vessel will be ready and on standby during construction activities. The availability of a safety vessel in the area of the marine works shall provide for rapid response to emergency situations and an overview of the activity being conducted; during Construction.
39	Dropped Object Procedure	A dropped object procedure will be in place to report and respond to any drop incidents.
40	Construction Surveys	Pre & post-construction surveys will be carried out to confirm that under keel clearences remain unchanged (in case of unreported incidents).
41	Loading/unloading plan	Equipment and materials being delivered by barge shall have plans specifying the order and method of loading and unloading at the marine works site.

12.8 Potential Impacts and Effects

12.8.1 This section assesses the potential marine transport and navigational hazards as a result of the construction and operation of the Project. The hazards that are considered in this assessment are taken from the Hazard Log of the NRA (**Appendix 12.A [TR030008/APP/6.4]**), which has more information on the assessment process and results.

12.8.2 Hazard scenarios, listed in **Table 12-7,** have been assessed in terms of their most likely and worst credible outcomes for each of the four criteria: people, property, planet, and port.

Table 12-7: List of Hazards

ID	Hazard Title
Construction Phase	
C1	Allision of the Project Works Craft with Port Infrastructure
C2	Allision of Passing Vessel with the Project Marine Works
C3	Collision of Passing Vessel with the Project Works Craft at or near construction site
C4	Collision of the Project Vessel during Navigation within the wider Humber
C5	Collision during Towage Operations

ID	Hazard Title
C6	Increased Collision Risk between other vessels due to Displacement away from the Construction Site
C7a	Increased Grounding Risk for Other Vessels due to Displacement from the Project Construction Area
C7b	Grounding Risk for the Project Works Craft
C8	Payload related incidents
Operational Phase	
O1	Collision risk due to Increased Traffic
O2	Collision risk due to Maintenance Dredging
O3a	Collision between Maneuvering Vessel at the Project and Passing Vessel
O3b	Allision between Passing Vessel and Berthed Vessel at the Project
O4a	Allison of Maneuvering Vessel with Port Infrastructure
O4b	Allision of Passing Vessel with the Project Infrastructure
O5	Mooring Breakout
O6	Increased Collision Risk between Other Vessels due to Displacement from the Project
O7	Increased Grounding Risk for Other Vessels due to Displacement from the Project

Construction

12.8.3 This section assesses the potential hazards as a result of the construction of the Project.

12.8.4 During the construction phase, there will be marine works involving various vessel activities including jack-up barges and capital dredging, as detailed in **Chapter 2: The Project [TR030008/APP/6.2]**.

12.8.5 The following potential impacts/risks have been identified for the construction phase of the Project:

C1: Allision of the Project Works Craft with Port Infrastructure

12.8.6 Manoeuvring of craft in close proximity to marine structures has the potential for contact with infrastructure during site development.

12.8.7 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Minor (low-speed) impact with jetty resulting in limited damage, and possibility of slight injury and/or minor spill.

b. Higher speed impact resulting in severe damage to vessel / jetty, causing pollution and loss of life.

12.8.8 The most likely scenario was deemed to have a frequency of Likely with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.9 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.10 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C2: Allision of Passing Vessel with the Project Marine Works

12.8.11 Tanker on passage to/from the IOT has the potential to make contact with the marine works.

12.8.12 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Minor impact with marine works resulting in limited damage to vessels / works, and possibility of slight injury and/or minor spill. Inspections and minor repairs required leading to delay.

b. Higher speed impact resulting in severe damage to vessel and/or marine works causing pollution and loss of life.

12.8.13 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Negligible (Port).

12.8.14 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.15 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C3: Collision of Passing Vessel with the Project Works Craft

12.8.16 As passing vessels (commercial, recreational or fishing) are manoeuvring around or in close proximity to the works there is the potential for collision with craft associated with the Project.

12.8.17 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Minor impact with works craft resulting in limited damage to vessels, and possibility of slight injury and/or minor spill.

b. Higher-speed collision between vessels resulting in severe damage, causing pollution and loss of life.

12.8.18 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.19 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.20 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C4: Collision of the Project Vessel during Navigation

12.8.21 Vessel collision (commercial, recreational or fishing) with works craft, e.g., capital dredger, whilst transiting to/from the Project or during activities within the disposal site (if required), i.e., in the wider River Humber area.

12.8.22 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Collision between works vessel and third-party vessel resulting in limited damage to one or both, and possibility of slight injury and/or minor spill.

b. Collision between works vessel and third-party vessel resulting in severe damage, causing pollution and loss of life.

12.8.23 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.24 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.25 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C5: Collision during Towage Operations

12.8.26 If materials for Project are transported through the use of barges, there is potential for collision with commercial or recreational vessels in the area.

12.8.27 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Collision between works vessel (tug and/or barge) and third-party vessel resulting in limited damage, and possibility of slight injury and/or minor spill.

b. Collision between works vessel (tug and/or barge) and third-party vessel resulting in severe damage causing pollution and loss of life.

12.8.28 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.29 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.30 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C6: Increased Collision Risk between other vessels due to Displacement away from the Construction Site

12.8.31 Other (third-party) vessels using the port have increased vessel-to-vessel collision risk with each other due to displacement caused by the Project.

12.8.32 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Limited displacement due to reduced sea room causing closer encounters with potential for minor collision between two vessels, and possibility of slight injury and/or minor spill.

b. Reduced sea room leads to a major collision incident between two passing vessels with resulting severe damage, causing pollution and loss of life.

12.8.33 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.34 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.35 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C7a: Increased Grounding Risk for Other Vessels due to Displacement from the Project Construction Area

12.8.36 Other (third-party) vessels using the port have increased grounding risk due to displacement away from the Construction Site.

12.8.37 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Limited displacement due to reduced sea room causing a proportion of vessels to pass marginally closer to shallow water or to have reduced under keel clearance due to part of transit.

b. Vessel displaced to a greater extent, possibly following an encounter, leading to grounding, resulting in severe damage, pollution and loss of life.

12.8.38 The most likely scenario was deemed to have a frequency of Unlikely with consequences of Negligible (People), Negligible (Property), Negligible (Planet) and, Negligible (Port).

12.8.39 The worst credible scenario was deemed to have a frequency of Rare with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.40 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C7b: Grounding Risk for the Project Works Craft

12.8.41 There is a risk of grounding for works craft doing construction work for the Project.

12.8.42 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Work vessel hull touches bottom or underwater infrastructure associated with project causing limited damage and possibility of slight injury and/or minor spill.

b. Work vessel grounds resulting in severe damage, pollution and loss of life.

12.8.43 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.44 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.45 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

C8: Payload Related Incidents

12.8.46 If lifting operations are required from barges/vessels associated with the Project, there is potential for incidents to arise from dropped items or affected vessel stability.

12.8.47 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Dropped object which is reported and recovered (if appropriate).

b. Unreported dropped object causing temporary under water hazard, e.g., reducing under keel clearance below chart datum, until detected during survey. Transiting vessel interacts with underwater hazard resulting in severe damage, pollution and loss of life.

12.8.48 The most likely scenario was deemed to have a frequency of Likely with consequences of Negligible (People), Minor (Property), Negligible (Planet) and, Negligible (Port).

12.8.49 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.50 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

Operation

12.8.51 This section assesses the potential hazards as a result of the operation of the Project.

12.8.52 The Terminal would operate 24 hours a day, seven days a week and 365 days a year. The Terminal would have capacity to accommodate up to 292 vessel calls per year and it is anticipated that up to 12 of these calls would be ammonia carriers associated with the hydrogen production facility.

12.8.53 During the operational phase, periodic maintenance dredging of the berthing pocket of the jetty may be required. The overall volumes of the maintenance dredging associated with the Project would be very small (if required at all) compared to that of the capital dredge.

12.8.54 The following potential impacts have been identified for the operational phase of the Project:

O1: Collision Risk due to Increased Traffic

12.8.55 Vessel-to-vessel collision risk increases (over baseline) due to the additional vessels (ammonia, CO_2 and other bulk liquids) transiting to/from the Project being involved in a collision with other vessel traffic using the port (e.g., commercial, dredging, recreational or fishing).

12.8.56 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Collision between Project vessel and 3rd party vessel resulting in limited damage to one or both, and possibility of slight injury and/or minor spill.

b. Collision between a project vessel and a 3rd party vessel resulting in more serious damage. Worst-case outcome of ammonia release and loss of life.

12.8.57 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.58 The worst credible scenario was deemed to have a frequency of Rare with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.59 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O2: Collision Risk due to Maintenance Dredging

12.8.60 Collision risk could potentially be increased (over baseline) due to increased maintenance dredger transit to/from the dredge pocket or during dispersal operations leading to encounters with other marine traffic (commercial, recreational or fishing).

12.8.61 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Collision between maintenance dredger vessel and 3rd party vessel resulting in limited damage to one or both, and possibility of slight injury and/or minor spill.

b. Collision between a maintenance dredger and a 3rd party vessel resulting in more serious damage. Worst-case outcome of spill and loss of life.

12.8.62 The most likely scenario was deemed to have a frequency of Possible with consequences of Minor (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.63 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.64 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O3a: Collision between Manoeuvring Vessel at the Project and Passing Vessel

12.8.65 Vessel manoeuvring near the Project berth is involved in a collision with passing vessel (commercial, recreational, or fishing).

12.8.66 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Collision between project vessel near berth and 3rd party vessel resulting in limited damage to one or both vessels, and possibility of slight injury and/or minor spill.

b. Collision between project vessel near berth and a passing vessel resulting in severe damage, ammonia release and loss of life.

12.8.67 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.68 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.69 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O3b: Allision between Passing Vessel and Berthed Vessel at the Project

12.8.70 This hazard can occur if a passing vessel (commercial, recreational, or fishing) contacts a vessel berthed at the Project. For example, tanker heading to/from IOT.

12.8.71 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Glancing impact between passing vessel and berthed vessel resulting in limited damage to one or both vessels, and possibility of slight injury and/or minor spill.

b. Higher energy impact resulting in severe damage, ammonia release, oil spill and loss of life.

12.8.72 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.73 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.74 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O4a: Allision of Manoeuvring Vessel with Port Infrastructure

12.8.75 Manoeuvring vessel, dredging vessel or tug associated with the Project in contact with port infrastructure, e.g., the Project berth or nearby structures such as IOT, as a result of collision avoidance, adverse weather, nature of the operation or interaction with a passing vessel.

12.8.76 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Minor (low-speed) impact resulting in limited damage to fender and/or vessel, and possibility of slight injury and/or minor spill.

b. Higher speed impact resulting in severe damage to vessel / structure, ammonia release and loss of life.

12.8.77 The most likely scenario was deemed to have a frequency of Likely with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Negligible (Port).

12.8.78 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.79 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O4b: Allision of Passing Vessel with the Project

12.8.80 Passing vessel (commercial, recreational, or fishing) contacts the Project infrastructure. For example, tanker heading to/from IOT.

12.8.81 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Glancing impact between passing vessel and the Project resulting in limited damage, and possibility of slight injury and/or minor spill.

b. Higher energy impact resulting in severe damage, oil spill and loss of life.

12.8.82 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.83 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.84 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O5: Mooring Breakout

12.8.85 This hazard can occur if a vessel breaks away from its mooring position.

12.8.86 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Vessel ranges from berth but is re-secured with or without tug assistance. Potential for minor contact with berth / fender, and delay in discharge time.

b. Vessel completely breaks mooring with risk of heavy contact with jetty, and/or drifting into channel with risk of escalation, e.g., collision, contact or grounding. Severe damage causing ammonia release and loss of life if breakout occurs during cargo transfer, and/or event escalates.

12.8.87 The most likely scenario was deemed to have a frequency of Likely with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.88 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.89 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O6: Increased Collision Risk between Other Vessels due to Displacement from the Project

12.8.90 Other (third-party) vessels using the port have increased vessel-to-vessel collision risk with each other due to displacement caused by the Project.

12.8.91 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Limited displacement due to reduced sea room causing closer encounters with potential for minor collision between two vessels.

b. Reduced sea room leading to a high-speed collision between two passing vessels causing severe damage, pollution and loss of life.

12.8.92 The most likely scenario was deemed to have a frequency of Possible with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.93 The worst credible scenario was deemed to have a frequency of Unlikely with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.94 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

O7: Increased Grounding Risk for Other Vessels due to Displacement from the Project

12.8.95 Other (third-party) vessels using the port have increased risk of grounding due to displacement caused by the Project.

12.8.96 The identified most likely and worst credible scenarios for this hazard are respectively:

a. Limited displacement due to reduced sea room causing a proportion of vessels to pass marginally closer to shallow water or to have reduced under keel clearance during part of transit.

b. Vessel displaced to a greater extent, possibly following an encounter, leading to vessel grounding, severe damage, pollution and loss of life.

12.8.97 The most likely scenario was deemed to have a frequency of Unlikely with consequences of Negligible (People), Minor (Property), Minor (Planet) and, Minor (Port).

12.8.98 The worst credible scenario was deemed to have a frequency of Rare with consequences of Extreme (People), Extreme (Property), Extreme (Planet) and, Extreme (Port).

12.8.99 Based on the embedded and planned risk controls, this risk is considered to be tolerable and ALARP, and **insignificant** in EIA terms.

Decommissioning

12.8.100 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms and access ramps would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on marine transport and navigation from decommissioning have been scoped out.

12.9 Assessment of Residual Effects

12.9.1 The residual effects of all the hazard scenarios were assessed to be tolerable and ALARP, and insignificant in EIA terms, based on the mitigation measures already in place and/or that will be put in place as part of the Project, identified in **Table 12-6**.

12.10 Summary of Assessment

12.10.1 This chapter has analysed the marine transport and navigational impacts of the Project.

12.10.2 A summary of the hazards that have been assessed, is presented in **Table 12-8**.

12.10.3 The hazards were ranked in terms of frequency and consequences to people, property, the planet, and the port based on their most likely and worst credible outcomes. In all cases, the risks were assessed to be tolerable and ALARP, and **insignificant** in EIA terms, based on the mitigation adopted by the Project.

Table 12-8: Summary of Potential Hazards and Impact Significance

Risk No.	Hazard Title	Impact Significance
Construction		
C1	Allision of the Project Works Craft with Port Infrastructure	Insignificant
C2	Allision of Passing Vessel with the Project Marine Works	Insignificant
C3	Collision of Passing Vessel with the Project Works Craft at or near construction site	Insignificant
C4	Collision of the Project Vessel during Navigation within the wider Humber	Insignificant
C5	Collision during Towage Operations	Insignificant
C6	Increased Collision Risk between other vessels due to Displacement away from the Construction Site	Insignificant
C7a	Increased Grounding Risk for Other Vessels due to Displacement from the Project Construction Area	Insignificant
C7b	Grounding Risk for the Project Works Craft	Insignificant
C8	Payload related incidents	Insignificant
Operation		
O1	Collision risk due to Increased Traffic	Insignificant
O2	Collision risk due to Maintenance Dredging	Insignificant

Risk No.	Hazard Title	Impact Significance
O3a	Collision between Manoeuvring Vessel at the Project and Passing Vessel	Insignificant
O3b	Allision between Passing Vessel and Berthed Vessel at the Project	Insignificant
O4a	Allison of Manoeuvring Vessel with Port Infrastructure	Insignificant
O4b	Allision of Passing Vessel with the Project Infrastructure	Insignificant
O5	Mooring Breakout	Insignificant
O6	Increased Collision Risk between Other Vessels due to Displacement from the Project	Insignificant
O7	Increased Grounding Risk for Other Vessels due to Displacement from the Project	Insignificant

12.11 References

Ref 12-1 Department for Transport, Maritime & Coastguard Agency (2016). *Port Marine Safety Code.*

Ref 12-2 International Maritime Organization (2018). Revised guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process.

Ref 12-3 UK Government (1987). Pilotage Act 1987. https://www.legislation.gov.uk/ukpga/1987/21/contents

Ref 12-4 Department for Transport, Maritime & Coastguard Agency (2018): A Guide to Good Practice on Port Marine Operations.

Ref 12-5 UK Hydrographic Office (2021). Admiralty Sailing Directions NP54 (12th edition).

Ref 12-6 Associated British Ports (2016). Pilotage Directions for ships to be navigated within the Humber pilotage area.

Ref 12-7 UK Legislation (2016). The Dangerous Goods in Harbour Areas Regulations 2016.

Ref 12-8 Maritime & Coastguard Agency (2022): Marine Guidance Note (MGN) 401 (M+F) Amendment 3 Navigation: Vessel Traffic Services (VTS) and Local Port Services (LPS) in the UK.

Ref 12-9 Merchant Shipping Notice (MSN) 1796 (Amendment 2) Vessel Traffic Services (VTS) - Designation of VTS Stations in the United Kingdom.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 13: Landscape & Visual Impact

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 13: Landscape & Visual Impact

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

Table of contents

13. Landscape and Visual Impact

13.1 Introduction

13.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on landscape, which encompasses both landscape and seascape character (as a resource in its own right) and visual amenity.

13.1.2 As there are interrelationships between the landscape and visual impacts and other disciplines, reference should be made to the following chapter:

a. **Chapter 8: Terrestrial Ecology [TR030008/APP/6.2]**.

13.1.3 A detailed description of the Project which includes an indicative construction phasing timeline, Project components, and parameters relating to the proposed maximum building heights, is included within **Chapter 2: The Project [TR030008/APP/6.2]**.

13.1.4 This chapter is supported by the following figures **[TR030008/APP/6.3]** and appendices **[TR030008/APP/6.4]**.

Figures

a. **Figure 13.1**: Project Location and Study Area.
b. **Figure 13.2:** Zone of Theoretical Visibility – Bare Earth.
c. **Figure 13.3**: Zone of Theoretical Visibility – Visual Screening.
d. **Figure 13.4**: Landscape Character Areas – National and Regional.
e. **Figure 13.5**: Landscape Character Areas – Local.
f. **Figure 13.6**: Designations.
g. **Figure 13.7**: Viewpoint Locations.
h. **Figure 13.8.1 - 13.8.13:** Summer Viewpoint Photography.
i. **Figure 13.9.1 – 13.9.13:** Winter Viewpoint Photography.
j. **Figure 13.10.1 – 13.10.6:** Photomontages.

Appendices

a. **Appendix 13.A** Landscape and Visual Assessment Methodology.
b. **Appendix 13.B** Landscape Character Baseline.

13.2 Consultation and Engagement

13.2.1 A scoping exercise was undertaken in August 2022 to establish the scope of the EIA including the methodology and approach of the landscape and visual impact assessment to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on

the landscape and visual environment. A Scoping Opinion was adopted by the Secretary of State for Transport on 10 October 2022 **[TR030008/APP/6.4]**.

13.2.2 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report (PEI Report), which was publicised at the consultation stage.

13.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

13.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 13-1**. The full responses to consultation comments are included within the **Summary of Consultation Responses** document **[TR030008/APP/5.1]**.

Table 13-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate ("PINS")	The Scoping Report seeks to scope out this matter [operational landscape and seascape effects] on the grounds that because of the existing industrial character of the area and the immediate surrounding area, landscape and seascape effects during the operational phase would be insignificant. The Inspectorate does not agree that this matter can be scoped out of further assessment and advises the Applicant to provide a comprehensive project description in the ES which includes the maximum dimensions of all the structures associated with the Proposed Development and visual representations to give the Examining Authority confidence that no significant environmental effects would arise.	Landscape and seascape effects during operation are assessed within this Environmental Statement ("ES") chapter at **Section 13.8.** Schedule 1 of the **draft Development Consent Order ("draft DCO") [TR030008/APP/2.1]** lists the key buildings and structures contained in the Project and the maximum heights of the permanent built elements are set out within the parameters section of **Chapter 2: The Project [TR030008/APP/6.2]**. Photomontages have been prepared at locations where significant visual effects have been identified and on the edge of Immingham town. Refer to **Figure 13.10.1** to **13.10.4 [TR030008/APP/6.3]**.
		Design measures to reduce the landscape and visual impacts of the Proposed Development are to be considered, such as lighting design. The ES should include a night-time character assessment prepared in co-ordination with a lighting assessment, demonstrating how the lighting design has been developed to minimise impacts.	Night-time baseline conditions are included in this ES at **Section 13.6** and night-time assessments for each character area and viewpoint are included in **Section 13.8.** A lighting assessment has been undertaken and is included in the ES, **Appendix 2.B [TR030008/APP/6.4].**

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The ES should include photomontages from representative viewpoints to support the visual impact assessment, including from Immingham Town. Photomontages should be prepared in line with relevant Landscape Institute guidance and viewpoints should be agreed with consultation bodies where possible.	North East Lincolnshire Council ("NELC"), North Lincolnshire Council ("NLC") and East Riding of Yorkshire Council ("ERYC") were consulted on the appropriate viewpoints (refer to stakeholder engagement (August 2022) within the table below for details of the responses obtained). The photomontages were prepared in line with Landscape Institute Technical Guidance Notes and other relevant legislation, policy and guidance as listed in **Table 13-2**. Photomontages have been prepared from locations from which likely significant visual effects are identified and from the edge of the residential areas within Immingham Town and illustrated on **Figure 13.10.1** to **13.10.6 [TR030008/APP/6.3]**.
	Natural England	Natural England would wish to see details of local landscape character areas mapped at a scale appropriate to the development site as well as any relevant management plans or strategies pertaining to the area. The EIA should include assessments of visual effects on the surrounding area and landscape together with any physical effects of the development, such as changes in topography.	Character areas located within the study area are outlined within **Appendix 13.B – Landscape Character Baseline [TR030008/APP/6.4]**. Landscape effects are assessed within **Section 13.8** and illustrated on **Figure 13.4 and Figure 13.5 [TR030008/APP/6.3]**.
		The England Coast Path (ECP) is a new National Trail that will extend around all of	The proposed England Coast Path ("ECP"), of which Bridleway 36 will form part, is considered

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		England's coast with an associated margin of land predominantly seawards of this, for the public to access and enjoy. Natural England takes great care in considering the interests of both land owners/occupiers and users of the ECP, aiming to strike a fair balance when working to open a new stretch. We follow an approach set out in the approved Coastal Access Scheme and all proposals have to be approved by the Secretary of State. We would encourage any proposed development to include provision for the England Coast Path, where appropriate, to maximise the benefits this can bring to the area. This should not be to the detriment of nature conservation, historic environment, landscape character or affect natural coastal change. Consideration for how best this could be achieved should be made within the Environmental Statement.	further within **Chapter 23: Socio-Economics [TR030008/APP/6.2]**. A temporary diversion of Bridleway 36 during Phase 1 of the construction of the Project would be provided to ensure continuity of access to the sea wall. Bridleway 36 would be reinstated upon completion of this construction phase and no impacts are expected on the future England Coast Path. Landscape effects are assessed within **Section 13.8**. Visual effects, including views from the proposed England Coast Path, are assessed within **Section 13.8**.
Stakeholder Engagement August 2022	North East Lincolnshire Council (NELC), North Lincolnshire Council (NLC) and East Riding of Yorkshire Council (ERYC)	NLC was in agreement with the selection of viewpoints and suggested an additional viewpoint to the north to represent views from the England Coast Path. No response from NELC or ERYC.	Visual effects, including views from the proposed England Coast Path, are assessed within **Section 13.8**. Additional viewpoint added at Public Right of Way ("PRoW") SKIL50, located within the administrative boundary of NLC and referenced as Viewpoint 10 and illustrated at **Figure 13.8.12** (Summer scenario) and **Figure 13.9.12** (winter scenario) **[TR030008/APP/6.3]**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Statutory Consultation January 2023	Humber Conservation	Requested details of the provisions that will be made to protect Long Strip and public footpath.	The pipeline corridor connecting the East Site to the Jetty as well as the Jetty Access Road (Work No. 2) would be situated within this woodland belt. Through an iterative design process, the Applicant has sought to minimise loss of the trees within this area. The proposed design includes techniques that enable the width of the construction areas, where practicable, to be reduced, for example by the vertical stacking of pipes on a supporting rack/structure in this location. The loss of part of the woodland from Long Strip is fully assessed in **Appendix 8.F Arboriculture Impact Assessment [TR030008/APP/6.4]**, **ES Chapter 8: Nature Conservation (Terrestrial Ecology [TR030008/APP/6.2]** and this Chapter]. Approximately 0.64ha of woodland will be removed from the Long Strip woodland, which represents 40% of that part of the Tree Preservation Order ("TPO") north of Laporte Road. An **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** has been prepared to set out the approach to management and enhancement of retained non-impacted sections of Long Strip woodland, and outline plans for the creation and long-term management of replacement woodland habitat, to provide compensation (in the long term) for permanent woodland loss associated with the Project within

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			Long Strip Woodland and will be secured by requirement of the draft DCO. The right of way through Long Strip comprises Bridleway 36, which will be temporarily diverted from Laporte Road to the sea wall during Phase 1. This is to enable the construction of works in this area and the use of the temporary construction area on the arable field to the east. Bridleway 36 would be re-opened on its existing alignment after the construction of phase 1. This is described in **ES Chapter 2: The Project [TR030008/APP/6.2]** and the impacts on theBridleway are assessed in **ES Chapter 23:Socio-Economics [TR030008/APP/6.2]**.
	Humber Nature Partnership	Requested consideration in relation to Long Strip woodland in terms of local history and landscape considerations, as well as the England Coast Path. Suggested that the woodland could be protected and the installations run along the adjacent Temporary Construction Area, with BW36 and the ECP similarly and permanently accommodated therein. Stated that the TCA (Temporary Construction Area) is large enough to provide beneficial mitigation and BNG considerations for this and other projects.	Landscape effects on the Long Strip Woodland are assessed within this chapter at **Section 13.8** and illustrated on **Figure 13.4** and **Figure 13.5 [TR030008/APP/6.3]**. Comments in relation to the potential to retain the Long Strip woodland and the alignment of Bridleway 36 are provided above in the response to comments raised by Humber Conservation. The Temporary Construction Area (Work No. 9) will only be used temporarily for Phase 1 of construction and would then be reinstated to its existing arable use and returned to the landowner.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Forestry Commission	In relation to climate change, the Forestry Commission recommended that biosecurity, tree health, and woodland resilience is considered for all new planting that is associated with the proposed development.	An **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** and **Outline Landscape and Ecology Management Plan** ("Outline LEMP") **[TR030008/APP/6.9]** have been prepared. A review of the landscape and biodiversity opportunities within the various parts of the Project shown on the Works Plans **[TR030008/APP/4.2]** (**Work Plans**) has been carried out and is included within the **Outline LEMP** and illustrated on **Figure 1 Indicative Landscape and Biodiversity Plan [TR030008/APP/6.9]**. Due to the limited opportunities for planting within the operational site boundaries, the main focus is on the off-site planting of trees in the Immingham area on land within the applicant's ownership and the management, and enhancement of retained non-impacted sections of Long Strip Woodland as outlined within the outline Woodland Compensation Strategy. The **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** would require that new planting broadly reflects the tree species that would be lost from the Long Strip and will follow the principles adopted within local tree planting guidance. It would also require that new planting considers provenance and that species would be selected for long-term value and

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			resilience to climate change. It is considered unlikely that Ash trees, which form a proportion of the existing trees in the woodland, would be included in the strategy, unless strains resilient to Ash dieback (*Hymenoscyphus fraxineus*) can be identified.
	North East Lincolnshire Council	The applicants have been working with NELC Trees and Landscape to look at initial high level issues; · Requested further consultation on the extent of tree removal required to implement the scheme and a landscape proposals plan which aims to improve the visual amenity on the periphery of the Project.	The extent of tree removal is presented in the **Arboricultural Impact Assessment** at **Appendix 8.F** the ES **[TR030008/APP/6.4]**. As above an **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** and **Outline LEMP [TR030008/APP/6.9]** have been prepared. There is limited opportunity for landscape proposals due to the constraints of the Project and requirement for secure boundaries, however, options for landscape and biodiversity areas within the Work Areas are included within the Outline LEMP and illustrated on **Figure 1 Indicative Landscape and Biodiversity Plan [TR030008/APP/6.9]**. The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide landscape and ecological measures to enhance the operational layout. The Outline Woodland Compensation Strategy sets objectives for the management and enhancement of retained non-impacted sections of Long Strip Woodland and outline plans for the creation and long-term management of

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			replacement woodland on land within the applicant's ownership.
	Local Resident (living within approx. 10km of the Project)	The outlook/views residents currently enjoy to the south east will be compromised with the numerous sized stacks planned for the plants on the East and West of the development.	Landscape and seascape effects during operation are assessed within this ES chapter at **Section 13.8.** Schedule 1 of the **draft DCO [TR030008/APP/2.1]** lists the key buildings and structures contained in the Project and the maximum heights of the permanent built elements are set out within **Chapter 2: The Project [TR030008/APP/6.2]**. Photomontages have been prepared at locations (i) where significant visual effects have been identified as likely and (ii) from the edge of Immingham town. Refer to **Figure 13.10.1** to **13.10.4 [TR030008/APP/6.3]**
	North East Lincolnshire Council	Stated the need to follow the new emerging policy with regards to tree replacement numbers	Tree planting will take into account the emerging policy as detailed within the **Outline Woodland Compensation Strategy [TR030008/APP/6.8]**.

13.3 Legislation, Policy and Guidance

13.3.1 **Table 13-2** presents the legislation, policy and guidance relevant to the assessment and details how their requirements have been considered.

Table 13-2: Relevant legislation, policy and guidance regarding the landscape/seascape and visual impact assessment

Legislation/ Policy/Guidance	Consideration within the ES
European Landscape Convention ("ELC") (Ref 13-1)	
The ELC recognises landscape in law. It focuses specifically on landscape issues and highlights the importance of integration of landscape into areas of policy to promote protection, management and planning of all landscapes including the assessment of landscape and analysis of landscape change.	The assessment aims to comply with the overarching aims of the ELC and considers relevant policies. These policies are outlined within this table. Landscape change is assessed using the landscape and visual baseline as described with **Section 13.6**.
National Policy Statement for Ports ("NPSfP") (Ref 13-2)	
The NPSfP provides the framework for decisions on proposals for new port development. The Project is considered to be a Nationally Significant Infrastructure Project ("NSIP") within the ports industry. Section 5.11.3 of the NPSfP requires a landscape and visual assessment to be undertaken and reference made to any landscape character assessment and associated studies, as a means of assessing landscape impacts relevant to the proposed project. It states that the assessment should take into account any relevant policies based on these assessments in local development documents. Section 5.11.4 states that the effects during construction on the project and the effects of the completed development and its operation components and landscape character should be included. Section 5.11.5 states that the visibility and conspicuousness of the project during construction and the presence and operation of the project and potential impacts on views and visual amenity including any light pollution effects on local amenity, rural tranquility and nature conservation.	Published national (Ref 13-23, Ref 13-24, Ref 13-25 and Ref 13-26), regional (Ref 13-27), and local (Ref 13-28, Ref 13-29, Ref 13-32, Ref 13-36 and Ref 13-37) landscape and seascape character assessments have been considered in determining the landscape baseline and the Project is assessed against the existing landscape context in terms of landscape character. The published character assessments are included in **Section 13.3**. The assessment considers the landscape and visual impacts of the Project during its construction and operation including the effects of lighting in **Section 13.8**.
The National Planning Policy Framework ("NPPF") (Ref 13-5)	
The revised NPPF was published in July 2021 and includes policies that ensure that these types of developments are:	**Section 13.3** outlines the published national, regional, and local landscape and seascape character assessments that have assisted to determine the landscape and seascape baseline. This section describes the existing

Legislation/ Policy/Guidance	Consideration within the ES
'sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change'. **'Policy 15**: Conserving and enhancing the natural environment recognises that the environment should be enhanced by: *b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;* *c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate….'* The NPPF sets out national planning policies that reflect priorities of the Government for operation of the planning system and the economic, social, and environmental aspects of the development and use of land. The NPPF has a strong emphasis on sustainable development, with a presumption in favour of such development.	area into which the Project would be located as industrial and containing port related uses. **Section 13.8** describes the likely effects of The Project against the existing landscape context in terms of the existing industrial nature of the landscape character. This section demonstrates how, for example, landscape character in the vicinity of Work No. 3 and Work No. 5 would be maintained by retaining the eastern edge of the existing Long Strip woodland and how the PRoW would be diverted (rather than closed) during the first phase of construction works to maintain access to the coast.
The National Planning Practice Guidance ("NPPG"): National Design Guide (Ref 13-6)	
NPPG paragraphs 52 and 53 outline the requirement to consider and respond to existing local character and identity. The guidance states that development should consider characteristics of local built form, height, scale, massing and relationships between buildings. Proposals should also consider the scale and proportions of new buildings within the existing landscape context.	This guidance has been taken into account in **Section 13.8** where the effects on landscape and visual amenity are assessed.
The National Planning Practice Guidance ("NPPG"): Natural Environment (Ref 13-6)	
Paragraph 36 of the NPPG explains the key issues and planning policies relating to the conservation and enhancement of the landscape and Paragraph 37 of the guidance states that an LVIA can be used to demonstrate the likely effects of a proposed development on landscape character.	This guidance has been taken into account in **Section 13.7** when defining the Project design and proposed mitigation measures.

Legislation/ Policy/Guidance	Consideration within the ES
North Lincolnshire Local Plan Publication Draft Addendum Plan (Ref 13-7)	
The following Policies are relevant to the Project: **DQE1** – Protection of landscape, townscape and views requires that development proposals do not cause unacceptable harm and protect the distinctive character and quality of the landscape. Development proposals should also take account of, views in to and out of development areas and preserve local views and vistas. **DQE12** – Protection of Trees, Woodland and Hedgerows states that trees, woodland, and hedgerows will be retained and protected, and planting schemes will be required to accompany applications for development.	The assessment considers landscape character and considers the effects of the Project on views within **Section 13.8**. **Section 13.7** describes the mitigation approach and the requirement to protect existing trees, woodland and hedgerows which are to be retained within the Site Boundary.
North East Lincolnshire Local Plan (adopted March 2018) (Ref 13-8)	
The following Policies are relevant to the Project: **Policy 22** - Good design in new developments, outlines North East Lincolnshire Councils ("NELCs") expectations in terms of the design approach for new development. The policy states the requirement for thorough consideration of the site's context, informed by the relevant published landscape character assessments and design guidance for NELC. **Policy 42** - Landscape states the requirement to refer to the published landscape character assessment to determine the local context of the proposed development. It states the requirement for a proportional and site-specific landscape appraisal. It also identifies the requirement for responsive design and mitigation by incorporating landscape buffers by way of suitable landscape planting if appropriate.	**Section 13.8** considers the published landscape character assessment and the landscape context in which the Project is to be located.
East Riding Local Plan (Ref 13-9)	
The following Policy is relevant to the Project: **Policy ENV2**: Promoting a high quality landscape *"Development proposals should be sensitively integrated into the existing landscape, demonstrate an understanding of the intrinsic qualities of the landscape setting and, where possible, seek to make the most of the opportunities to protect and enhance landscape characteristics and features. To achieve this, development should:* *Protect and enhance views across valued landscape features, including flood meadows, chalk grassland,*	Views from the East Riding of Yorkshire administrative boundary are considered as part of the assessment at Viewpoint 1 and included within **Table 13-4**.

Legislation/ Policy/Guidance	Consideration within the ES
lowland heath, mudflats and salt marsh, sand dunes and chalk cliffs."	
The North Lincolnshire Local Development Framework Development Plan Documents ("DPDs") – Core Strategy (adopted June 2011*)* (Ref 13-10)	
The following Policies are relevant to the Project. **Policy CS5** - Delivering quality design in North Lincolnshire notes that all new design in North Lincolnshire should be well designed and appropriate for its context. It notes that developments should incorporate appropriate landscaping and planting that enhances biodiversity and contributes to green infrastructure. **Policy CS12** - Biodiversity and landscape character of the Humber Estuary should be protected and enhanced by harmonising the landscape with port related development activities. The policy states that the South Humber Gateway Conservation Mitigation Strategy Delivery Plan will develop new green infrastructure directly linked to the Green Infrastructure Strategy for North Lincolnshire.	**Section 13.6** considers the surrounding landscape context through the use of published landscape character assessments. **Section 13.7** describes the mitigation approach and considers the requirement to protect and retain existing trees, woodland and hedgerows located within the Site Boundary and summarises how these have been addressed in the Project design.

13.4 Assessment Methodology

13.4.1 The methodology used within this assessment is set out within **Appendix 13.A [TR030008/APP/6.4].**

13.4.2 The LVIA has been undertaken taking into account the following best practice guidance:

a. Landscape Institute and Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment, Third Edition. (GLVIA3) (Ref 13-11).

b. Landscape Institute (2019). Technical Guidance Note (TGN) 06/2019: Visual Representation of Development Proposals. (Ref 13-12).

c. Landscape Institute (2021). Assessing landscape value outside national designations, Technical Guidance Note 02/21. (Ref 13-13).

d. Landscape Institute (2020). Infrastructure, Technical Guidance Note 04/2020 Limitations and Assumptions. (Ref 13-14).

13.4.3 In the LVIA, effects are formulated as a function of the value, susceptibility and sensitivity of the receptor, and the nature of effect/magnitude of impact (or change) predicted. A combination of professional judgement, defined thresholds, established criteria and standards have been used in their definition.

13.4.4 Whilst the identification of effect significance has involved the application of professional judgement, the overarching significance matrix used in the EIA shown in Table 5.3 in **Chapter 5: EIA Approach [TR030008/APP/6.2]** has

provided a guide for that process. Effects which are major and moderate are considered significant and effects which are minor or negligible are not significant.

Use of Rochdale Envelope

13.4.5 The design of the Project incorporates a degree of flexibility in the dimensions and configurations of buildings and structures to allow for the future detailed design and selection of the preferred technology and contractor. Therefore, the Landscape and Visual Impact Assessment ("LVIA") has been undertaken in accordance with the Planning Inspectorate Advice Note Nine: Using the Rochdale Envelope (Ref 13-15). The anticipated components for the Project and in particular its main buildings and structures are detailed in **Chapter 2: The Project [TR030008/APP/6.2]**.

13.4.6 The magnitude of visual impacts associated with the Project relates to (amongst other criteria) the size of the buildings and structures and geographical extent of the area influenced by them. Given this, the assessment is based upon Schedule 1 of the **draft DCO [TR030008/APP/2.1]** which lists the key buildings and structures in each part of the Project (defined by Work Nos.), the Works Plans **[TR030008/APP/4.2]** which set out the maximum geographical extent of each Work No. and the maximum heights of the permanent built elements as set out within the parameters section in **Chapter 2: The Project [TR030008/APP/6.2]**.

Baseline Data Collection

13.4.7 In addition to the published landscape character assessments, as described within **Appendix 13.B [TR030008/APP/6.4]** and **Section 13.4**, the following information sources have been consulted to establish the baseline landscape and visual conditions:

a. Mapping data from Natural England, including National Character Areas, Country Parks, Local Nature Reserves (Ref 13-16).

b. Mapping data from Historic England including Listed Buildings, Registered Parks and Gardens (Ref 13-17).

c. Google Earth (Ref 13-18).

d. Google Street View (Ref 13-19).

e. Open-Source Data including MAGIC (Ref 13-20).

f. AECOM Geospatial Information (Ref 13-21).

g. Mapping data from CPRE The Countryside Charity including England's Light Pollution and Dark Skies Map (Ref 13-22).

13.4.8 Visits to the study area were conducted on 7 September 2022 and 6 October 2022 to define baseline conditions and identify local receptors and landscape features. Following the initial site visit, the viewpoint located at St Peter's and St Paul's Church was discounted as described within **Table 13-4**.

13.4.9 The weather during these visits was fair, with sunny intervals and light cloud and good visibility.

13.4.10 A further visit was conducted on 26 January 2023 to define the winter baseline scenario when screening by vegetation is reduced. The weather was generally overcast with some sunny intervals and good visibility.

Limitations and Assumptions

13.4.11 The information presented in this assessment is based on the design for the Project, and the vertical and spatial parameters as described within **Paragraph 13.4.5** above.

13.4.12 The landside elements of the Project have a design life of up to approximately 25 years. The impacts on landscape character and visual amenity arising as a result of Project decommissioning for the landside elements are considered to be similar to those identified at the construction stage of the Project. For landscape, this is as a result of the scale and nature of the development in relation to the existing industrial structures and complexes present in the wider landscape and the large scale of the landscape character areas. For visual amenity, this is as a result of the visibility of decommissioning and demolition activities being of a similar nature to those during construction for the landside elements.

13.4.13 The Project does not make any provision for the decommissioning of the marine facilities of the Project (except where infrastructure on the topside of the jetty has been used, and is decommissioned, in parallel with hydrogen production facility) and therefore the impacts on landscape and seascape character and visual amenity have not been assessed for these elements.

13.4.14 Once the decommissioning process has been completed, it is anticipated that the resulting conditions would be similar to those that currently exist as detailed in **Chapter 2: The Project [TR030008/APP/6.2**] with the exception of the marine facilities (Work No. 1 and Work No. 2 in part) which will be maintained for port-related activities.

13.4.15 The photomontages (**Figures 13.10.1 – 13.10.6**) are for illustrative purposes and provide a fair representation of what might be seen if the Project was built. The photomontages are based on likely design and height information available at the time of production and the assessments made within this Chapter rely on professional judgement as described within **Appendix 13.A [TR030008/APP/6.4]** taking account of the parameters for the Project described within **Paragraph 13.4.5** above.

13.4.16 Due to the temporary diversion of Bridleway 36, the assessment of visual effects during construction (and decommissioning) at Viewpoint 3 takes into consideration a temporary diversion route is proposed between the two points BB and BA shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**, with users being diverted around the eastern perimeter of the temporary construction area which would be established on the area defined for Work No. 9, to reconnect with the retained bridleway further to the east on the sea wall. Once the first phase of construction is completed, the bridleway would be re-instated on its current alignment and the temporary diversion would be closed.

13.5 Study Area

13.5.1 The extent of the study area is determined by the potential visibility of the Project in the surrounding landscape and is proportionate to the size and scale of the proposals and nature of the surrounding landscape. GLVIA3 (Ref 13-11) states that the study area should include '*the full extent of the wider landscape around it which the Proposed Development may influence in a significant manner*'.

13.5.2 The study area has been defined by a combination of Zone of Theoretical Visibility ("ZTV") analysis and professional judgement. The ZTV is based on the vertical parameters within each area of the works as set out on the **Works Plans [TR030008/APP/4.2]** and within **Chapter 2: The Project [TR030008/APP/6.2]**. It is considered that it is highly unlikely that significant effects would be experienced further than 3km from the Site. A study area of 2.5km was identified within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**); however, following further review this coverage was extended to 3 km to include locations on the north-coast of the Humber Estuary within the East Riding of Yorkshire.

13.5.3 An additional viewpoint, Viewpoint 10, was added as requested by NLC which represents views from the England Coast Path. The viewpoint is described in **Table 13-4** and assessed in **Table 13-9**.

13.6 Baseline Conditions

Existing Landscape and Seascape Baseline

Landscape and Seascape Characterisation

13.6.1 The following section outlines the relevant landscape characteristics as described within the published landscape character assessments at a national, regional, and local scale. Further detail is provided within **Appendix 13.B [TR030008/APP/6.4]**.

National Character Areas

13.6.2 At a national scale Natural England provide 159 National Character Area ("NCA") profiles. Each profile includes a description of the natural and cultural features that shape the landscape. The study area encompasses two NCA profiles as follows:

a. NCA 41: Humber Estuary (Ref 13-23).

b. NCA 42: Lincolnshire Coast and Marshes (Ref 13-24).

13.6.3 Due to the scale of the Project in relation to the NCAs and the lack of intervisibility between the Project and NCA 42, NCA 42 has been discounted as a receptor in the assessment, and there will be no further reference to it.

13.6.4 The relevant characteristics of NCA 41 are described below and illustrated in **Figure 13.4 [TR030008/APP/6.3]**.

13.6.5 NCA 41: The Humber Estuary covers the Project and part of the study area. The character area is broadly split into two components, the largest being the expanse of water associated with the Humber Estuary. The estuary is formed by

the confluence of several major rivers, including the Trent, Don, Aire, Ouse and Hull, and discharges into the North Sea. Due to its strategic position, the estuary facilitates important and busy trade routes. The land adjacent to the coast is described as a '*low-lying estuarine landscape with extensive stretches of intertidal habitats'*. Due to these elements, the landscape has international significance as a Ramsar site, along with several other designations. The character area provides a varied landscape, with open and extensive views across remote and rural areas, contrasting with heavy industry associated with towns and ports. Due to the factors outlined above, such as the international designations and the influence of the heavy industry, the value of this NCA is assessed to be medium.

National Seascape Character Assessment

13.6.6 At a national scale the study area includes the Marine Character Area ("MCA"): East described in the National Seascape Character Assessment for England (MM01134) (Ref 13-25) and illustrated on **Figure 13.4 [TR030008/APP/6.3]**.

13.6.7 The MCA East is subdivided into distinct areas within the Seascape Character Area Assessment East Inshore and East Offshore marine plan areas (Ref 13-26) and the Project is located within Character Area 6: Humber Waters. The area is illustrated on **Figure 13.4 [TR030008/APP/6.3]**. The relevant characteristics of MCA 6 Humber Waters are summarised below.

13.6.8 MCA 6 Humber Waters is the second largest coastal plain estuary in the UK and is bound by intertidal mud and sand flats and saltmarsh. These habitats provide internationally important wildlife corridors. Spurn Head, located to the north of the Humber, is a designated feature for geomorphology and wildlife habitats. The character area contains the UK's largest port complex and views are dominated by an extensive and complex mix of industrial, commercial, agricultural, residential and tourism land uses. Shipping traffic using the local ports provide a dominant animated feature. The value of the MCA is assessed to be medium as there are important designated features located within the character area, however the character is heavily influenced by industrial presence.

Regional Character Assessment

13.6.9 At a national scale the Project and study area is located within the Regional Character Area ("RCA") Area 3: The Northern Marshes within The Historic Landscape Characterisation Project for Lincolnshire (English Heritage and Lincolnshire County Council, 2011) (Ref 13-27). The RCA is defined by the industrial features along the coast clustered around the deep-water Port of Immingham. The assessment describes the visual dominance and unique character created by views of the large and tall structures, such as Lindsey Oil Refinery, which are linked with the port and heavy industry. The value of this character area is assessed to be low as the area is dominated by industrial elements and processes.

Local Character Assessment

13.6.10 The study area is covered by three published local Landscape Character Assessments:

a. North East Lincolnshire Council Landscape Character Assessment (Ref 13-32).

b. East Riding of Yorkshire Landscape Character Assessment (Ref 13-28).

c. North Lincolnshire Landscape Character Assessment and Guidelines (Ref 13-29).

North East Lincolnshire Council Landscape Character Assessment

13.6.11 The NELC Landscape Character Assessment (Ref 13-37) divides the landscape of North East Lincolnshire into three broad Character Areas, with the Project being located within Area A – Humber Estuary.

13.6.12 Area A – Humber Estuary is sub-divided into Local Landscape Types ("LLTs"), with the Project located within LLT 1 Industrial Landscape. The character of this area is described as '*Landscapes visually dominated by large or massive structures serving as docks, storage, factories or petrochemical installations. These structures are often separated by extensive open arable land with hedges and groups of trees playing little compositional role in the landscape*.'

13.6.13 Other key characteristics applicable to the study area located with LLT 1 are as follows:

a. Flat and visually open landscape.

b. Large scale industrial works including Immingham Power Station and docks set against large skies.

c. Detracting features such as heavy industry, pylons and wirescape, and busy roads.

d. Established low cut field boundaries and hedgerow trees with taller vegetation along road networks.

13.6.14 The NELC Landscape Character Assessment (Ref 13-37) notes that value of LLT 1 is assessed to be very low due to the dominance of detracting features and industry.

13.6.15 Parts of the study area fall within LLT 2: Open Farmland which has key characteristics as follows:

a. Flat landform emphasising large skies with open views towards the industrial areas and docks.

b. Medium to large scale arable farmland with limited development.

c. Detracting features such as distant views of industry, pylons, and busy road network.

13.6.16 The NELC Landscape Character Assessment notes that value of LLT 2 is assessed to be low due to its proximity to the industrial areas and presence of dominating features within the landscape.

13.6.17 Parts of the study area also fall within LLT 3: Wooded Open Farmland which has key characteristics as follows:

a. Virtually flat landform emphasising large skies although gentle undulations are present.

b. Medium to large scale open arable farmland with some woodland blocks with tall hedgerows and mature trees along roadside boundaries.

c. Some detracting features such as pylons, and busy road network.

13.6.18 The NELC Landscape Character Assessment notes that value of LLT 3 is assessed to be medium as the landscape is intact and considered to be in moderate condition. Views of industry are distant and intervening features such as woodland blocks enable detracting features to be accommodated within the character area. Due to the distance from the Project and lack of intervisibility, this character area has been discounted for the purposes of this assessment with no further reference.

East Riding of Yorkshire Council ("ERYC") Landscape Character Assessment

13.6.19 The eastern part of the study area falls within the ERYC Landscape Character Assessment (Ref 13-28). The area is categorised as Area 21: Drained Farmland Local Landscape Character Type. This landscape character type is then sub-divided into four further character areas. The sub-area applicable to the study area is Area 21B: Sunk Island.

13.6.20 Some of the key characteristics of Area 21: Low Lying Drained Farmland are as follows:

a. Flat and low-lying flood plain of the River Humber.

b. Sparse tree cover.

c. Open and extensive views across a bleak and featureless landscape.

d. Sky dominates views across the flat open landscape.

13.6.21 Area 21B: Sunk Island is a Conservation Area and exists as an area of historic reclaimed land. Tree and vegetation cover is sparse, and the area is described as bleak. Settlements exist as scattered farmsteads.

13.6.22 The ERYC Landscape Character Assessment notes that the value of Area 21B: Sunk Island is assessed to be high as this area is a Conservation Area and the lack of landscape elements and built form creates a unique character despite the distant views of industry on the horizon.

North Lincolnshire Landscape Character Assessment and Guidelines

13.6.23 A review of the current North Lincolnshire Landscape Character Assessment was commissioned by JBA Consulting (Ref 13-36) and forms part of the evidence base for the emerging North Lincolnshire Local Plan (Ref 13-7). The assessment subdivided the Landscape Character Areas ("LCAs") into LCTs. Parts of the study area fall within the Humber Estuary LCA which has key characteristics as follows:

a. Predominantly low-lying estuarine landscape with large skies and open views.

b. Changing character due to tidal influences with low tide revealing extensive areas of mudflats.

c. Limited vegetation cover, although where blocks of woodland occur, these are visually prominent within the view.

d. Urban and industrial influences.

13.6.24 The Local Character Type ("LoCT") within the Humber Estuary LCA is Industrial Landscape. The key characteristics defining the Industrial Landscape are as follows:

a. Low lying and flat, however, gently undulates as it extends west.

b. Dominated by heavy industry with remnant pockets of flat open farmland.

c. Detracting features such as heavy industry and urban influences such as fences, signs, and major transport corridors.

13.6.25 The assessment states that "Landscape infrastructure elements are insignificant within the industrial landscape. Ornamental mitigation planting and amenity trees in grass verges are generally out of scale with the vertical infrastructure and industrial mass."

13.6.26 The value of this LCA is assessed to be very low due to the dominance and scale of the industry and the inability of landscape elements, as outlined above, to accommodate these detracting features.

Vegetation Cover

13.6.27 Tree and shrub cover within the study area is generally sparse. Woodland blocks, where they exist, are visually prominent within the flat landscape. Field boundaries are predominantly native hedgerows that are generally poorly maintained. Taller hedgerows and hedgerow trees tend to be located along roads, adjacent to settlements, and on the outer extents of the study area, where the landscape features tend to be in better condition.

13.6.28 The relatively low vegetation cover within the study area means that woodland, hedgerows and trees within parts of the Site, form prominent landscape features, including an area of woodland known as Long Strip covered by a TPO. The extent and location are illustrated on **Figure 2.1 Site and Surrounding Environment [TR030008/APP/6.3]**.

Topography and Drainage

13.6.29 The topography of the study area is low lying and flat, with many areas formed as historically reclaimed land. An extensive network of ditches artificially drains the land and divides agricultural land into medium to large scale rectilinear fields.

Settlements

13.6.30 The study area is characterised by heavy industrial development associated with Immingham and the docks. Immingham, the main settlement, is located to the west of the Site. Stallingborough, a smaller settlement, is located to the south of the Site on the edge of the study area. Several isolated farmsteads are scattered throughout the study area.

Communications

13.6.31 The study area is connected to major road networks via the A180 which becomes the M180 and connects to the M18, M62 and A1(M) further to the west (outside the study area). Immingham and Stallingborough are connected by Stallingborough Road (B1210). The Project is connected to the Port and the major road network via a series of A and B roads.

13.6.32 There are a number of PRoW within the study area, including Bridleway 36, running north from Laporte Road, which forms part of the proposed route for the England Coast Path between the Humber Bridge and Easington (to the north of the Humber) and Mablethorpe to Humber Bridge (to the south of the Humber). The part of the Bridleway 36 located within the Site is illustrated on Map MHB 3l: North Beck Drain to Queens Road (Ref 13-35).

Night-time Context

13.6.33 The study area is influenced by existing high levels of artificial light and sky glow associated with heavy industry and major infrastructure networks. Aviation lighting and flairs on tall structures are visible across the study area.

Landscape and Seascape Character of the Project Site and Immediate Setting

13.6.34 The Project is situated on land that extends from the A1173 (to the east of Immingham) across to the southern coastline of the Humber and to the south of Immingham Docks. The full extent of the Project is shown on **Figure 2.1 [TR030008/APP/6.3]** and described within **Chapter 2: The Project [TR030008/APP/6.2]**.

13.6.35 The Site is split into multiple areas comprising the following:

a. Terminal area (Work No. 1) located within the marine areas of the River Humber and including the adjacent seawall. The area comprises intertidal coastal features exposing mud flats during low tide as well as the grassy banks of the sea wall flood defences, with rock armour and concrete revetments. There is no formal public access to the tidal area, however, Bridleway 36 which forms part of the proposed England Coast Path is located along the top of the sea wall flood defences. This area is adjacent to

the existing Immingham Oil Terminal and jetty and the marine areas are influenced by shipping activity.

b. Corridor between the jetty and Laporte Road (Work No. 2) including a section of woodland known as 'Long Strip' that is subject to a TPO. Bridleway 36 extends along the eastern edge of Long Strip and connects Laporte Road to the sea wall forming part of the proposed England Coast Path. Influenced by industrial areas and port activity to the north and industry to the south-east.

c. The East Site (Work No. 3 and Work No. 5) comprises two parcels of land which are bisected by Laporte Road comprising an area of hardstanding to the north currently used as a storage area, and an area of brownfield land to the south containing a gravelled area and stockpiles of materials. The two parts of the East Site would be linked by a culvert (Work No. 4) under Laporte Road. The areas are bound by woodland and mature vegetation, including Long Strip to the east, and industrial areas. Laporte Road and adjacent industrial areas influence the character of this site.

d. The West Site (Work No. 7) comprises agricultural fields bound by hedgerows and drainage ditches. The A1173 bounds the West Site to the west and Kings Road to the north. There is a short tarmac access road into the West Site from Kings Road. The West Site is influenced by the adjacent roads and industry, such as the electrical sub-station and power generator to the north-west and gypsum landfill site to the south. Residential and small-scale commercial properties located on Queens Road are located to the north-east boundary of the West Site and there is an area of hardstanding between the properties and the West Site used as storage for a number of large vehicles.

e. Underground Pipeline Corridor (Work No. 6) between the East Site and West Site alongside Queens Road. This corridor is impacted by adjacent industrial development and road network and contains some patchy mature vegetation.

f. Temporary Construction Areas to the north of Laporte Road located on agricultural land (Work No. 9) and on a brownfield area with crushed materials adjacent to existing buildings, off Queens Road (Work No. 8). Work No. 8 does not support substantive vegetation and is not considered relevant to the assessment that follows.

13.6.36 Existing light pollution levels on the Site are high as shown on the England's Light Pollution and Dark Skies interactive map and is available to view online (Ref 13-22). Artificial light sources from adjacent land use, such as road networks and industrial areas, influence the perceptual night-time character of the Site.

Value of the Landscape Receptor

13.6.37 **Table 13-3** provides details of the landscape areas and features of relevance to the Project, and their overall landscape value, based on Assessing landscape value outside national designations, Technical Guidance Note 02/21 (Ref 13-11).

Table 13-3: Non-designated Landscape and Seascape Areas/ Features

Factor	Study Area	The Project Site
Natural Heritage	There are multiple natural heritage elements including national and international designations such as a Special Area of Conservation (SAC), a Special Protection Area (SPA), Ramsar, RSPB important bird areas. There is also a Local Wildlife Site ("LWS") located on Laporte Road, close to the Project.	The Project would be located partly within, and partly on land adjacent to, the Humber Estuary Special Area of Conservation ("SAC"), Special Protection Area ("SPA"), Ramsar site and Site of Special Scientific Interest ("SSSI"), collectively referred to as the Humber Estuary European Marine Site ("EMS"). Long Strip is subject to a TPO.
Cultural Heritage	The study area contains cultural heritage assets including: two Scheduled Monuments, and a Heritage Conservation Area. There are twelve Listed Buildings distributed across the study area.	There are no cultural heritage designated interests located within the Site Boundary.
Landscape/Seascape Condition	The landscape and seascape of the study area is predominantly open, low-lying land around the coast, influenced by industry, pylons and transport routes. Heavy industry is located around the deep-water Port of Immingham. Other parts of the study area are low lying open arable land with scattered buildings/ farmsteads. The landscape to the north of the Humber is described as bleak. Landscape quality is poor where industry and power stations are present, however, more rural areas on the outer limits of the study area have a moderate to good landscape condition. The seascape is influenced by heavy industry and port infrastructure and operations.	Generally poor condition with the East Site (Work No. 3 and Work No. 5) comprising brownfield land and influenced by adjacent industrial land use. The West Site (Work No. 7) comprises former agricultural fields, however, these are also influenced by Queens Road, an electrical sub-station, with overhead electricity cables. Field boundaries, where they exist on the West Site, are poorly managed and comprise overgrown species-poor hawthorn. Within the East Site and adjacent to the boundary is a narrow belt of TPO woodland known as the 'Long Strip' Mature trees and vegetation also exist along highway verges along Laporte Road within the Site Boundary. The area located within the Humber is adjacent to, and influenced by, the existing Oil Terminal Jetty.

Factor	Study Area	The Project Site
Scenic quality	Views comprise open flat landscapes with large skies and seascapes with views across intertidal mudflats and open water. The industrial complex associated with the Port has a strong visual influence over the generally flat, low-lying surrounding landscape and seascape creating a dramatic skyline. The more rural areas on the outer limits of the study area, to the south of the railway line and to the north of the Humber (Sunk Island), have fewer detracting features. However, Sunk Island is described as bleak due to its lack of features and sense of remoteness due to its coastal location.	Western parts of the Site have a very low scenic quality. To the east, the scenic quality increases due to the dynamic qualities and expansive views over the Humber Estuary where they exist.
Associations	No literary value, connections with notable people or arts has been identified.	No literary value, connections with notable people or arts has been identified.
Distinctiveness	The study area contains urban features which are distinctive to the location. The Humber Estuary and intertidal habitats create a unique landscape. The strong industrial presence with flat topography and large skies creates a strong sense of place. The industrial influences found within the study area is representative of the identified landscape character at a national, regional, and local level.	Few distinctive features. The Site's identity is informed by the coastline, brownfield land and adjacent industry. Long Strip forms an identifiable feature.
Recreational	The landscape within the study area contains PRoW which include both footpaths and bridleways. These generally radiate from Immingham and connect to the surrounding countryside. The proposed England Coast Path as a new National Trail will provide an additional recreational route. The recreational value is low, however, a campsite is located within the northern extents of the study area.	In terms of formal rights of way, part of the proposed route upgrade to the England Coast Path is located on Bridleway 36 within the Site Boundary and adjacent to the Site Boundary. There is no other formal PRoW within the Site. The Humber Estuary, including foreshore areas, are accessible informally from the sea wall within the Site Boundary and from more accessible access points in adjacent areas although levels of usage are relatively low. There is also informal access through the southern part of Long Strip woodland, south of Laporte Road.

Factor	Study Area	The Project Site
Perceptual (Scenic)	The study area is not a landscape that has evident value through appealing to the senses, primarily the visual sense. The study area contains small areas regarded as tranquil and remote, especially on the northern and southern limits of the study area where detracting features are less prominent. The scenic value of the seascape is influenced by industry along the coastline and shipping activity within the Humber. Tranquillity of the general area is eroded by major transport corridors and imposing industrial presence.	The Site has no particular or notable scenic value, albeit Long Strip adds to value in an otherwise industrial context.
Perceptual (Wildness, tranquillity and dark skies)	The study area contains small areas regarded as tranquil and remote, especially on the northern and southern limits of the study area. Tranquillity of the general area is eroded by major transport corridors and imposing industrial presence. Large scale industry with tall elements, and major transport corridors introduce high levels of artificial light into the night-time scenario and has influence across the study area.	Tranquillity is low due to adjacent land use and activity associated with the Port. Existing artificial lighting levels and light spill within the Site are high.
Functional	The industrial development, port infrastructure, residential areas and transport corridors form the main functions within the study area. The study area has ecological functions within the Humber Estuary and as described above.	Industrial, brown field, and undeveloped land has left areas of the Site without a clear or defined function. Marine areas and linear belts of vegetation such as the Long Strip woodland and other tree belts and hedge lines provide ecosystem services.
Overall landscape value	**Low** The study area does not include any areas designated locally for their landscape character and/or perceptual qualities/tranquillity. The study area is also heavily influenced by industrial development, port infrastructure, residential areas and transport corridors both on land and within the Humber.	**Low** The Project is located in an area surrounded by existing industrial development with few important landscape features. The landscape elements within the Site Boundary do not contribute to the landscape or seascape value or contribute distinguishing features to the identified landscape or seascape character. The Site contains features such as the England

Factor	Study Area	The Project Site
		Coast Path route and the Long Strip woodland.

Existing Visual Baseline

Zone of Theoretical Visibility ("ZTV") Analysis

13.6.38 In order to identify locations with potential views of the Project, a ZTV for bare earth (**Figure 13.2:** Zone of Theoretical Visibility – Bare Earth) and one including visual screening (**Figure 13.3**: Zone of Theoretical Visibility – Visual Screening) have been produced. These identify those areas which have potential for views of the Project and to what extent it is likely to be visible. The ZTVs are illustrated in **Figure 13.2** and **Figure 13.3 [TR030008/APP/6.3]**.

13.6.39 The ZTVs were produced on a worse-case scenario basis using the spatial parameters for the Work Areas as set out in **Paragraph 13.4.5** above. The ZTV is based upon a grid of points spaced 50m apart within the required Works Areas as illustrated within **Figure 2.3 [TR030008/APP/6.3**].

13.6.40 The ZTVs were generated by analysis of a 3D digital terrain model ("DTM") of the surrounding terrain and the Project. The bare earth ZTV has been generated using Ordnance Survey ("OS") Terrain 5 digital terrain data which does not take into account the screening effects of vegetation, buildings or other structures. The visual screening ZTV has been generated using the same data and uses woodland from the Forestry Commission National Forest Inventory (Ref 13-39) with an assumed tree height of 15m, building height data from OS Master Map and buildings from OS Open with an assumed height of 7.5m. The ZTVs are based upon an observer eye height of 1.6m.

13.6.41 The ZTV illustrates that the visibility within the Study Area is generally widespread as a result of the low landform and limited intervening features such as hedgerows, woodland blocks and settlements.

Visual Receptors and Viewpoints

13.6.42 Visibility within the wider study area is generally extensive due to the low-lying land along the coast and lack of intervening vegetation. There are open views from the north-east coastline of the Humber Estuary towards the Site and adjacent industrial areas in the south-west. There are also open and extensive views from the Site and adjacent areas towards to north bank of the Humber Estuary. Where views are available, they are expansive and comprise large skies which are broken with vertical features and structures associated with industrial activity.

13.6.43 Users of the main transport routes and the proposed England Coastal Path would gain dynamic views towards the Project to varying degrees, dependent on intervening structures, screening vegetation, elevation and direction of travel.

13.6.44 Users of the railway line between Stallingborough and Habrough would gain transient, dynamic views towards the Project at an oblique angle. Views would include a landscape containing large areas of farmland, industrial structures, overhead power lines and highway infrastructure.

13.6.45 Within the study area there are a number of local roads in proximity to the Project which connect Immingham and the Port to major road networks. Generally, views whilst travelling on these roads are dynamic and vary at different points along the road depending on the level of enclosure and intervening features. At locations closer to the Project, views are often restricted by screening vegetation and built form located along the road corridors.

13.6.46 Due to the flat landscape, visibility is restricted in closer proximity to the Project by built form and vegetation, providing contrasts between enclosure and expansive views.

13.6.47 Through consultation and agreement with NLC, a total of 12 viewpoints were chosen to represent the typical range of views of the Project within the study area. Following the summer survey, one viewpoint, labelled as NV within **Table 13-4** and illustrated on **Figure 13.7** was discounted due to intervening structures which restrict views towards the Site**.** Representative viewpoints are listed in **Table 13-4** and illustrated on **Figures 13.8.1** to **13.8.13** for the summer baseline and **13.8.14** to **13.8.26** for the winter baseline **[TR030008/APP/6.3]**.

Table 13-4: Representative Viewpoints

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
1	PRoW PAULF06/ Cherry Cobb Sands Road. Proposed England Coast Path	Users of PRoW	1.15	523506, 418907	Viewpoint 1 is located on the northern coastline of the Humber Estuary where Cherry Cobb Sands Road meets PRoW PAULF06. The path forms part of the proposed England Coast Path Route. The view is open and expansive over the flat landscape with distant views to the south. There is a high level of tranquillity and remoteness at this location. The view extends across the mudflat and saltmarsh coastal margin and open water of the Humber Estuary to the southern coastline of the Estuary. The landscape at the viewpoint is characterised by low tussocky vegetation associated with mudflats and open shallow pools connected by tributaries to the Humber. Development in this location comprises occasional isolated dwellings and a number of small fishing boats moored at Stone Creek. The southern coastline and horizon are defined by an almost continuous line of industrial development, including large structures and tall vertical elements. There are also several large shipping vessels located within the Estuary, which obscure views of the coastline. The viewpoint is located within close proximity to Scheduled Monument - Stone Creek heavy Anti-aircraft gun site, at Sunk Island Clough. Artificial lighting from industrial areas, including aviation lighting on tall structures, is visible along the southern coastline with skyglow across the horizon. Lighting associated with shipping activity within the Humber Estuary will also be visible within the night-time context. No sources of lighting are present at the viewpoint location. **Value of the view:** The view is considered to be locally valued and enables expansive views across the Humber Estuary, providing some scenic value. The value of the view is assessed to be medium.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
2a and 2b	PRoW NKIL50 Proposed England Coast Path	Users of PRoW	4.79	521630, 415255	Viewpoint 2 (2a and 2b) is located on the coastal path to the east of the Project and looks west towards the East Site. On land, the view is confined to medium range and enclosed by a narrow woodland belt, Long Strip, which is located adjacent to the bridleway/PRoW and the north-western boundary of the Site. The view comprises the coastal path which extends along the flood defences, the coastal margin with mudflats and low vegetation, the existing jetty with landside infrastructure associated with the Port, and industrial buildings and infrastructure located on Laporte Road. There are also some taller structures visible above the tops of the trees. Location subject to high levels of light pollution and skyglow from adjacent industry and road networks. **Value of the view:** The view is considered to be locally valued and enables expansive views across the Humber Estuary, providing some scenic value. The value of the view is assessed to be medium.
3	PRoW Bridleway 36 Proposed England Coast Path	Users of bridleway/ PRoW	5.5	521311, 415505	Viewpoint 3 is located on the proposed England Coast Path to the west of the Site and looks east along the existing flood defences and path. The view is open and comprises distant views down the Humber Estuary to the south-east. To the south is an existing bridleway/PRoW (Bridleway 36), which is enclosed by mature trees (Long Strip) and vegetation to the west and a small to medium sized field to the east. More distant features comprise structures and buildings associated with industry which include tall vertical elements. Location subject to high levels of light pollution and skyglow from adjacent industry and road networks. **Value of the view:** The view is considered to be locally valued and enables expansive views across the Humber Estuary, providing some scenic value. The value of the view is assessed to be medium.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
4a and 4b	Queens Road	Local road users and commercial premises	2.2	521311, 414743	Viewpoint 4 (a and b) is located on Queens Road. To the north, the road is bound by a pavement and wide grass verge with commercial units adjacent. To the south, the road is bound by a rough grass verge with scattered vegetation. Views are confined to the medium range by intervening scrubby vegetation and small blocks of mature trees. Street lighting, road signs, parked cars, and Queens Road Power Station introduce detracting features into the scene. Overhead pylons and a spoil heap are also visible in the distance to the south. Location contains street lighting and is subject to high levels of light pollution from adjacent industry and road networks. **Value of the view:** The view is heavily influenced by urban development, detracting features and industry. The value of the view is assessed to be low.
5	PRoW to the east of Immingham	Users of the PRoW	2.12	509289, 414779	Viewpoint 5 is located on a PRoW between the eastern edge of Immingham and Kings Road. The view extends over a small to medium sized arable field containing the PRoW. A small footbridge crossing a drain with scrubby vegetation occupies the foreground with mature vegetation enclosing the horizon. Detracting features such as an industrial facility, Queens Road Power Station, overhead pylons and a spoil heap are also visible in the distance to the south. The view looks to the east towards the West Site. Suburban location adjacent to areas with high levels of light pollution from industry. Existing aviation lighting likely to be visible on the horizon. **Value of the view:** The view contains many rural elements. However, it is influenced by detracting features and industry The value of the view is assessed to be low.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
6	PRoW to the rear of Ings Lane/Talbot Road	Residents located to the edge of Immingham and users of the PRoW	1.98	519048, 414526	Viewpoint 6 is located on the eastern edge of Immingham to the rear of residential development on Ings Lane/Talbot Road. The view extends east across an area used recreationally and comprises rough grass, scrub, and a small area of woodland with a tarmac car parking area in the foreground. Views of industry are available to the north-east where gaps in the vegetation allow for more distant views. Suburban location adjacent to areas with high levels of light pollution from street lighting and industry. Existing aviation lighting likely to be visible on the horizon through gaps in the vegetation with skyglow visible across the horizon. **Value of the view:** The view contains some detracting features, however, it is considered to be valued locally. The value of the view is assessed to be low.
7	PRoW to the north west of Mauxhall Farm	Users of the PRoW	3.16	519090, 413323	Viewpoint 7 is located on a PRoW to the south-west of the West Site. The view extends over the large arable field in which the footpath is contained. The landscape is open and flat. The horizon is enclosed by mature vegetation and marked by the presence of heavy industry and vertical infrastructure, such as pylons and cranes. Views towards areas with high levels of light pollution from industry. Existing aviation lighting and skyglow likely to be visible on the horizon. No direct light sources are present at the viewpoint location. **Value of the view:** The view contains some detracting features, however, it is considered to be valued locally. The value of the view is assessed to be low.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
8	PRoW to the north western edge of Stallingborough	Residents located to the edge of Stallingborough	1.81	520649, 412061	Viewpoint 8 is located on a PRoW to the rear of houses on Station Road, Stallingborough. The landscape is open and flat and generally rural in character. The view extends over medium to large arable fields with occasional mature trees and small patches of scrub. The horizon is enclosed by mature vegetation. A network of pylons introduces vertical elements and detracting features into the scene. The stacks and flare stack at Lindsey Oil Refinery is just visible on the horizon to the north west. Views towards areas with high levels of light pollution from industry. Existing aviation lighting and skyglow likely to be visible on the horizon. **Value of the view:** The view contains some detracting features and, is considered to be valued locally. The value of the view is assessed to be low.
9	B1210 (adjacent to the railway line)	Users of the local road	10.54	518447, 412430	Viewpoint 9 is located on the B1210 to the south-west of the Project. The landscape is open and flat and generally rural in character with a recently ploughed field forming the midground. The A1173 is located within the mid-view adding moving vehicles to the scene. The horizon is enclosed by mature vegetation and built form. Tall vertical elements, such as the cranes associated with the Port, stacks, overhead pylons, and street lighting are visible across the horizon. Existing aviation lighting and illumination from industrial areas likely to be visible on the horizon with additional lighting from traffic movements and street lighting. Light sources at the viewpoint location are limited to headlights from vehicles. **Value of the view:** The view contains detracting features across the extent of the horizon. The value of the view is assessed to be low.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
10	PRoW SKIL50 Proposed England Coast Path	Users of the PRoW	3.57	518160, 417989	Viewpoint 10 is located on the proposed England Coast Path approximately 3.5 km to the north-west of the Project and falls outside the study area. The view comprises heavy industrial elements associated with the Docks, including the Ore Terminal, associated infrastructure, and jetties. The view is dynamic and tranquillity is low. Location subject to high levels of light pollution from adjacent industry and headlights from vehicles on the road network. **Value of the view:** The view is dominated by detracting features, however, is considered to be valued locally. The value of the view is assessed to be low.
11	Kings Road, Immingham	Residents of houses and commercial receptors	>10m	519676, 414814	Viewpoint 11 is located on Queens Road to the north of the West Site. The residential receptors are located on the west of Queens Road with the rear of the properties orientated to face south-west towards the West Site. Views from the front of the properties are orientated towards Queens Road and commercial buildings located to the east of Queens Road. The main focus of the view from the front of the residential properties is the road, with its associated features such as parked cars along both sides, street lighting and metal fencing. The view is enclosed by commercial development, which includes a series of prefabricated metal and brick buildings containing light industry and offices. These buildings are partially screened by a single row of trees and ornamental planting. To the rear of the residential properties, extends a series of three former agricultural fields which comprise the West Site. The fields are flat and open and allow for views across to Kings Road Power Station (adjacent to the north-western corner of the West Site). Views of tall vertical elements, such as overhead pylons, structures associated with Kings Road Power Station and street lighting are likely from the rear of the residential properties.

Viewpoint ID	Name & Location	Receptor Type	Elevation m (AOD)	Grid Reference	View
					Location subject to high levels of light pollution from adjacent industry, street lighting and headlights from vehicles on the road network. **Value of the view:** The view contains detracting features across the horizon and the focus of the view is of the road and commercial/ industrial buildings located along the road. The value of the view is assessed to be low.
NV	St Peter's and St Paul's Church and PRoW	Users of the PRoW and visitors to the church	8.31	519491, 411803	The viewpoint was visited, however, there were no available views towards the Site from this location due to intervening landform and vegetation and it is therefore discounted from the assessment. The viewpoint is located at Scheduled Monument – Stallingborough medieval settlement, post medieval manor house and formal gardens and within close proximity to Scheduled Monument – Churchyard cross 20m south of St Peter and St Paul's Church. The Viewpoint is shown on **Figure 13.7 [TR030008/APP/6.3]** as 'nv' (no view).

Summary of Visual Baseline

13.6.48 The extent of views of the Project available to receptors range from close range views to long distance views. Receptors are located at the edge of villages, along roads and transport networks and on various PRoW within the study area.

13.6.49 The study area is characterised by low lying arable land, influenced in most parts by industrial development and the Port. Large scale pylons and transmission lines transect the landscape and tall cranes within the Port. Due to the low-lying landform within the study area, views of these structures are available where vegetation and built form allow. In localised areas, small, isolated woodlands and boundary vegetation offer a degree of visual enclosure. Much of the vegetation within the study area is deciduous, therefore, there will be varying degrees of visibility depending on the time of year.

13.6.50 The night-time context is influenced by high levels of lighting from industrial areas, street lighting within residential areas, and transport corridors. Tall structures within industrial areas contain aviation lights which are likely to be visible across the study area.

Future Baseline

13.6.51 The future baseline is a prediction of baseline conditions in the future, assuming that the Project is not constructed. In the absence of the Project, parts of the Site will continue to be utilised for port activity. As such, the future landscape/ seascape and visual baseline, including night-time baseline, at a site scale is anticipated to be similar to the existing baseline as described.

13.7 Development Design and Impact Avoidance

Mitigation Measures

13.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to landscape/seascape and visual receptors through the process of design development, and by embedding mitigation measures into the design.

13.7.2 The opportunity for mitigation of the visual effects of the Project is limited due to the size and scale of the Project. It is considered that the addition of landscape features such as trees and woodland would not be effective in reducing these effects on visual amenity.

13.7.3 **Table 13-5** outlines the embedded and standard mitigation measures for the Project in relation to landscape and visual effects. More detail on mitigation measures is set out within **Chapter 5: The EIA Process [TR030008/APP/6.2]** and the **Schedule of Mitigation and Monitoring [TR030008/APP/7.2]**.

Table 13-5 Mitigation Measures

Category	Mitigation Measures
Embedded mitigation measures - developed through the iterative design process, which have become integrated or embedded into the project.	a. Valued trees, woodland, existing vegetation and other landscape features have been protected and retained wherever possible, in accordance with BS5837:2012. Trees in relation to design, demolition and construction. During construction trees would be clearly fenced or marked so that site operatives are in no doubt as to which ones are to be kept and protected as included within the **Outline Construction Environmental Management Plan ("CEMP") [TR030008/APP/6.5]**. b. The TPO designation on the Long Strip woodland indicates value/importance at a site level and through an iterative design process the landtake and subsequent associated tree loss has been minimised. A proposed building has been relocated to avoid impacting a veteran tree within the woodland as detailed in **Chapter 3: Needs and Alternatives [TR030008/APP/6.2]**.
Standard mitigation measures- construction and operational management practices for avoiding and reducing environmental effects	a. The selection of finishes for the buildings and other infrastructure will be dictated by the process function of the equipment. Appropriate materials will be used on buildings to minimise adverse impacts on visual amenity. Indicative construction and colours of proposed structures and buildings is outlined in **Chapter 2: The Project [TR030008/APP/6.2]**. Approval of materials for key buildings and paint finish of the ammonia storage tank will be secured by Requirement. b. The **Lighting Assessment Report, Appendix 2.B [TR030008/APP/6.4]**, outlines the lighting requirements during the construction and operation stages of the Project to reduce unnecessary light spill outside of the Site Boundary.

13.7.4 Construction of the Project would be subject to measures and procedures defined within a CEMP, which would be produced prior to the commencement of construction by the Principal Contractor and would be based on, and incorporate, the contents and requirements of the **Outline CEMP [TR030008/APP/6.5]** which is submitted with the DCO application. The CEMP is secured by DCO Requirement.

13.8 Assessment of Likely Impacts and Effects

13.8.1 The construction, operation and decommissioning of the Project have the potential to result in adverse impacts on landscape/seascape character and visual amenity. This an industrial process facility that will be sited in a predominantly industrial landscape.

13.8.2 The potential impacts of the Project primarily relate to the visibility of proposed structures (temporary and permanent), including how this affects the perceptual qualities and tranquillity of a character area and the direct loss of landscape features within the Site Boundary.

13.8.3 With regard to the Project construction phase (and decommissioning), potential landscape/seascape and visual amenity impacts relate to the following:

a. Construction of the marine infrastructure including dredging. Dredging to take place within the subtidal area.

b. Minor losses of scattered scrub where this coincides with localised areas required for temporary works.

c. Temporary prevention of farming of areas of arable farmland to be used for construction laydown activities.

d. Loss of trees within the Long Strip woodland to facilitate the development of the operational access road to the jetty and pipeline corridor.

e. The introduction of stationary and moving plant including cranes and piling rigs, jack-up barge and other high-level construction machinery and marine construction vessels.

f. The introduction of low-level construction operations including temporary stockpiling or storage of materials, contractor/welfare facilities and temporary laydown areas.

g. Construction vehicles including heavy goods vehicles (“HGV”) entering and leaving the Site and surrounding area.

h. The progressive construction of tall structures, including new flare stacks and the ammonia storage tank.

i. Construction lighting to illuminate site operations after dark and for site security.

13.8.4 With regard to the Project’s operational and commissioning phase, potential landscape impacts relate to the following:

a. Operation of large-scale buildings and structures and marine infrastructure including a jetty with a single berth, with topside infrastructure.

b. Operational access points connecting the Project with local roads (including Laporte Road, Kings Road and the A1173).

c. Site lighting, where required for operational safety and site security.

d. Movement of additional vehicles and shipping vessels within and around the operational area, jetty and within the Humber Estuary.

e. Potential visibility of plumes and infrequent flares (in exceptional circumstances, i.e. for emergency use only and during start up and shut down, rather than routinely noting that flares are to be fitted with shroud to minimise visibility of pilot).

13.8.5 These potential impacts and effects are considered in detail in the assessment that follows.

Landscape/Seascape Effects

13.8.6 **Table 13-6** provides an assessment of the sensitivity of the landscape receptors identified within the study area. The Site has been assessed as a single receptor but has been divided into sub-areas due to the scale of the Site and range of characteristic landscape elements.

Table 13-6: Landscape Sensitivity Assessment

Landscape/seascape receptor		Sensitivity Assessment		
	Value	Susceptibility	Sensitivity	Sensitivity Rating
Natural England National Character Area Profiles (Ref 13-23 and Ref 13-24)				
NCA 41: Humber Estuary	Medium	Very Low	The low-lying open landscape contains some nationally significant conservation features, although is influenced by the presence of existing large-scale infrastructure. Susceptibility to change arising from the Project is therefore considered to be very low due to the scale of the Project in relation to the character area. In addition, the introduction of industrial elements, including lighting, is considered to be consistent with the identified defining characteristics of the NCA.	Low
National Seascape Character Assessment for England (MM01134) (Marine Management Organisation, 2018) (Ref 13-25)				
MCA 6: Humber Waters MCA: East	Medium	Very Low	Bound by intertidal mud and sand flats and saltmarsh, the habitats within this character area provide internationally important wildlife corridors. Spurn Head, located to the north of the Humber, is a designated feature for geomorphology and wildlife habitats. The character area contains the UK's largest port complex and views are dominated with an extensive and complex mix of industrial, commercial, agricultural, residential and tourism land uses. Shipping traffic utilising the ports provide a dominant animated feature. Susceptibility to change arising from the Project is therefore considered to be very low as the introduction of industrial elements, including lighting, is consistent with the defining characteristics as described above.	Low

Landscape/seascape receptor		Sensitivity Assessment		
	Value	Susceptibility	Sensitivity	Sensitivity Rating
The Historic Landscape Characterisation Project for Lincolnshire (Ref 13-27)				
RCA Area 3: Northern Marshes	Low	Very Low	The published landscape character assessment states that the landscape is heavily influenced by industrial features and that despite the presence of detracting features, the industry creates a character which is dramatic and unique. The industrial development respects the historic landscape pattern by continuing the existing orientation and rectilinear form. Susceptibility to change arising from the Project is therefore considered to be very low due to the existing landscape context in relation to the industrial features.	Low
North East Lincolnshire Landscape Character Assessment Sensitivity and capacity Study (FPCR Environment and Design Ltd, 2015) (Ref 13-32)				
LCA Area A – Humber Estuary LLT 1 – Industrial Landscape	Very Low	Very Low	The landscape does not contain any designated features and the condition is described as poor within the landscape character assessment. The landscape is heavily influenced by large scale industry and light pollution, and there are many detracting features which influence the landscape character. Tranquillity is further eroded by the network of busy roads, such as the A180 and A1173. The susceptibility to change arising from the Project is considered to be very low as the introduction of industrial elements is consistent with the defining characteristics.	Very Low
LCA Area A – Humber Estuary LLT2 – Open Farmland	Low	Low	The area contains Great Coates Conservation Area (outside the study area) and is considered to be in moderate condition as described within the published landscape character assessment. Distant views of industry in the daytime and night-time context form part of the identified character.	Low

Landscape/seascape receptor		Sensitivity Assessment		
	Value	**Susceptibility**	**Sensitivity**	**Sensitivity Rating**
			The susceptibility to change arising from the Project is considered to be low.	
North Lincolnshire Landscape Character Assessment and Guidelines (Ref 13-33)				
The Humber Estuary LCA Landscape Character Type – Industrial Landscape	Very Low	Very Low	The landscape is degraded in places containing a high number of detracting features including industrial development along the coastline. Tranquillity is assessed to be low. Susceptibility to change arising from the Project is considered to be very low as the introduction of industrial elements is consistent with the defining characteristics.	Very low
East Riding of Yorkshire Landscape Character Assessment (2018) (Ref 13-28)				
Drained Farmland LCA 21 21B – Sunk Island	High	Very Low	The area is a Conservation Area and contains a number of ecological designations. It is considered to be in reasonable condition. Detracting features are present within the landscape along the horizon on the southern coastline of the Humber. The susceptibility to change arising from the Project is considered to be very low as the area will be able to accommodate the Project without compromising the baseline situation.	Medium
Site and Immediate Setting				
Landscape and Seascape Character of the Site and immediate setting - Humber Estuary (Work No. 1)	Low	Low	Character influenced by large shipping vessels and existing jetties protruding seawards into the Humber. The susceptibility of the offshore area to changes arising from the Project is assessed to be low due to the proximity of existing similar structures and capacity to accommodate development of this nature.	Low
Landscape and Seascape Character of the Site and immediate	Low	Low	Character influenced by traffic movements and disturbance associated with Laporte Road. Industrial development, such as the Associated Petroleum Terminal works complex,	Low

Landscape/seascape receptor		Sensitivity Assessment		
	Value	**Susceptibility**	**Sensitivity**	**Sensitivity Rating**
setting - Landside Landscape Features - East Site (Work No. 3 and Work No, 5)			inform the character of the East Site and its immediate setting and introduces dominant detracting features. The land is currently brownfield land and contains areas of hard-standing, gravel, and various stockpiles. Therefore, the susceptibility of the East Site to changes arising from the Project is assessed to be low.	
Landscape and Seascape Character of the Site and immediate setting - Landside Landscape Features - West Site (Work No. 7)	Low	Low	Comprises three former agricultural fields bound by hedgerows and ditches. The West Site has a simple character which is influenced by Queens Road, Kings Road, and the A1173 adjacent to the boundary. Industrial complexes located on Queens Road, two sub-stations, and overhead pylons reduce the West Site's susceptibility to the Project. Therefore, the susceptibility is assessed to be low.	Low
Landscape and Seascape Character of the Site and immediate setting - Landside Landscape Features within Pipeline Areas and access road (Work No. 2)	Low	Medium	A new jetty access road and pipe-racks (comprising Work No. 2) would impact Long Strip woodland (covered by a TPO) and further mature trees and vegetation along the road corridor to Laporte Road. The extent of tree loss is considered in detail within the (**Arboricultural Impact Assessment Appendix 8.F [TR030008/APP/6.4]**). Due to the presence of mature trees and the TPO, the sensitivity of the receptor is assessed to be medium. The main pipeline corridor (Work No. 6) linking the East Site (Work No 5) with the West Site (Work No 7) would be entirely underground	Medium
Landscape and Seascape Character of the Site and immediate setting - Landside Landscape Features within temporary	Low	Low	Located adjacent to Laporte Road and Queens Road, these areas are influenced by the adjacent busy road networks and detracting features such as overhead pylons and industrial complexes. The tranquillity within the areas is low. The susceptibility of the temporary Construction Laydown Areas to construction activity associated with the Project is assessed to be low.	Low

Landscape/seascape receptor		Sensitivity Assessment		
	Value	Susceptibility	Sensitivity	Sensitivity Rating
Construction Laydown Areas (Work No. 8 and Work No.9))				
Landscape and Seascape Character of the Site and immediate setting - Overall character	Low	Low	The pattern of the landscape ranges from degraded to intact and the Site is dominated by industrial complexes and activity. The tranquillity across the Site is low due to adjacent industrial land uses and road networks. Overall, the susceptibility to change arising from the Project is considered to be low due to its location within the surrounding industrial landscape context.	Low

13.8.7 The Project would introduce new large-scale industrial development and marine infrastructure into an area where heavy industry and port facilities is an established land-use. Pylons, overhead lines and transport networks, including shipping within the Humber, are dominant and form the landscape and seascape context to the Project. These features inform the landscape and seascape character immediately adjacent to the Project.

13.8.8 Taking into account the embedded mitigation measures referred to above, the Project characteristics and the prevailing landscape, **Table 13-7** provides an assessment of the potential landscape and seascape effects associated with the Project construction (and decommissioning) phase, whilst **Table 13-8** considers effects during Project operation. It is considered that the effects identified associated with Project construction are also applicable to the Project decommissioning phase for the landside infrastructure associated with the hydrogen production facility (the marine infrastructure is to remain in operation as part of the operational port, beyond the anticipated 25-year design life of the hydrogen production facility).

Table 13-7: Assessment of Landscape and Seascape Effects - Construction

Landscape /seascape type	Sensitivity of receptor	Description of impact	Predicted magnitude of change	Classification of effect
NCA 41: Humber Estuary	Low	Construction activities associated with the Project will directly impact the NCA. Construction activities will be viewed in context with other large-scale industrial developments and port infrastructure. Due to presence of the existing large-scale industrial development which lies within this NCA and the type of construction activities being undertaken, it is considered that the Project will have very limited potential to affect the landscape character and perception of the NCA in the short term. Impacts will be over a small geographical extent, short term and reversible and therefore the magnitude is assessed as **very low**. This will result in a negligible adverse not significant effect.	Very Low	Negligible adverse (not significant)
MCA 6: Humber Waters	Low	The Project will introduce construction activities which will directly impact the MCA. This will include dredging to facilitate the construction of the jetty. Other marine and landside construction activity, including marine construction vessels, will add visible disturbance and impact the tranquillity of the MCA. Construction activities will be viewed in context with other large-scale industry and appear in context with the already dynamic landscape and existing large-scale jetties. The size and scale of the construction works associated with the Project is medium in relation to the MCA and the key daytime and night-time characteristics of the landscape will be retained. Impacts will be over a medium geographical extent, short term and reversible, therefore the magnitude is assessed as **low**. This will result in a minor adverse not significant effect.	Low	Minor adverse (not significant)
LLT 1 – Industrial Landscape	Very Low	Construction associated with the Project will directly impact the LLT as a result of construction activities and removal of landscape features. Construction activities will be viewed in context with other large-scale industry, however the tranquillity within LLT will be eroded further. Due to the presence of these large-scale structures within this LLT and the nature of construction activities, it is assessed that the Project will have a limited potential to impact the daytime and night-time landscape characteristics. Impacts will be	Very Low	Negligible adverse (not significant)

Landscape /seascape type	Sensitivity of receptor	Description of impact	Predicted magnitude of change	Classification of effect
		over a medium geographical extent, short term and reversible, therefore the magnitude is assessed as **very low**. This will result in a negligible adverse not significant effect.		
LLT2 – Open Farmland	Low	The Project lies outside of this LCT but will introduce views of construction activity into it. Distant views of industry to the east, against large skies, is characteristic of this area. Views of industry, together with the network of high voltage pylons, introduce detracting features into the landscape. It is anticipated that the construction of the Project will result in a limited perceptible change to the daytime and night-time landscape character and tranquillity. The impact is over a small geographical extent, short term and reversible, therefore the magnitude of change is assessed as **very low**. This will result in a negligible adverse not significant effect.	Very Low	Negligible adverse (not significant)
21B – Sunk Island	Medium	The Project lies outside of this LCT but will introduce views of construction activity into it. Due to expansive views containing large-scale structures including Killingholme Oil Refineries, Immingham Oil Terminal, Immingham Docks, and other heavy industry, it is considered that the construction of the Project will result in limited perceptible change to the daytime and night-time landscape character and tranquillity. The impact is over a small geographical extent, short term and reversible, therefore the magnitude of change is assessed as **very low**. This will result in a negligible adverse not significant effect.	Very Low	Negligible adverse (not significant)
The Site and its immediate setting	Low	The Project will require the construction of large-scale marine and landside infrastructure onto a site which is already set within the context of an industrial landscape. Construction methods to include dredging, piling, Horizonal Directional Drilling (“HDD”) and/or digging of open trenches for pipelines and will include the delivery of construction materials and plant. Construction activity will result in the further erosion of tranquillity and features which will contribute additional disturbance and movement. Temporary construction compound and laydown areas and temporary site access at multiple locations will result in the removal of arable farmland and vegetation. Vegetation removal will also be required to facilitate new entrances connecting to existing roads.	Medium	Moderate adverse (significant)

Landscape /seascape type	Sensitivity of receptor	Description of impact	Predicted magnitude of change	Classification of effect
		Elsewhere, construction will include the clearance of site vegetation and some of the Long Strip woodland for the construction of the pipeline and the jetty access road to the east of the East Site. Construction will result in temporary operations to remove and change some of the landscape elements, such as site vegetation, arable farmland, and existing areas of hard standing within the Site. Construction will strengthen the industrial character of the landscape of the Site and within the immediate setting. There will also be a reduction in tranquillity generally, however, this will be less pronounced due to its location adjacent to existing industrial areas. The impact is over a medium geographical extent, short term and reversible (with the exception of the tree removal), therefore the magnitude of change is assessed as **medium**. This will result in a moderate adverse effect which would be significant.		

Table 13-8: Assessment of Landscape and Seascape Effects - Operation

Landscape type	Sensitivity of receptor	Description of impact	Predicted magnitude of impact	Classification of effect
NCA 41: Humber Estuary	Low	The Project will be located within the NCA and as such will result in direct and indirect change. While the Project will introduce additional built development and infrastructure into this NCA, change will largely occur within areas influenced by previous and existing industrial development and infrastructure. The impact will be over a small extent, will be long term and reversible and will have very little influence on the character or perceptual qualities of this NCA. Therefore, the magnitude of change is assessed to be **very low**.	Very Low	Negligible adverse (not significant)

Landscape type	Sensitivity of receptor	Description of impact	Predicted magnitude of impact	Classification of effect
MCA 6: Humber Waters	Low	The Project will introduce marine infrastructure and additional structures which will directly impact the MCA. Large shipping vessels are currently present within the landscape, however, the Project will introduce additional movement and further erode the tranquillity of the character area. Large structures, such as the ammonia tank and flare stack will be viewed in context with other large-scale industry and appear in context with the industrial landscape for the daytime and night-time scenario. The size and scale of the Project is proportionate in relation to the character area in general, and the key characteristics of the landscape will be retained. The impact is over a small geographical extent, long term and reversible, therefore the magnitude is assessed to be **low**. This will result in a minor adverse not significant effect.	Low	Minor adverse (not significant)
LLT 1 – Industrial Landscape	Very Low	The Project will directly impact the LLT as large new structures, such as the ammonia tank, vent stack, and flare stack will appear on the skyline and the jetty will encroach into the Humber Estuary. The flat low-lying landscape is heavily influenced by large scale industrial works and the Project will be viewed in context with other large-scale industry in the daytime and night-time scenario. Due to presence of these large-scale structures within this LLT and the nature of the proposals, it is assessed that the Project will have a limited potential to affect the landscape character and perception of the area. The impacts will be over a small geographical extent, long term and reversible, therefore the magnitude of change is assessed as **low**. This will result in a minor adverse not significant effect.	Low	Minor adverse (not significant)
LLT2 – Open Farmland	Low	The Project lies outside of this LCT, however, views of the Project from open locations will be available. These will appear as distant views and within the context of existing industry in the daytime and night-time scenario. These views of industry, together with the network of high voltage pylons introduce detracting features into the landscape. It is considered that the visible structures associated with the Project will result in limited perceptible change to the landscape character and tranquillity. The impact is over a small geographical extent, short term and reversible, therefore the magnitude of change is assessed as very low. This will result in a negligible adverse not significant effect.	Very low	Negligible adverse (not significant)

Landscape type	Sensitivity of receptor	Description of impact	Predicted magnitude of impact	Classification of effect
21B – Sunk Island	Medium	The Project lies outside of this LCT but will introduce views of the Project from within the character area. Due to expansive views containing large-scale structures, including Killingholme Oil Refineries, Immingham Oil Terminal, Immingham Docks and other heavy industry, it is considered that the Project will result in a limited perceptible change to the landscape character and tranquillity for the daytime and night-time scenario. The impact is over a small geographical extent, short term and reversible, therefore the magnitude of change is assessed as **very low**. This will result in a negligible adverse not significant effect.	Very low	Negligible adverse (not significant)
The Site and its immediate setting	Low	The Project will directly impact the Site and its immediate setting as large new structures will be present where there is currently an absence of these features. The Site is heavily influenced by adjacent large scale industrial works and the Project will be viewed in context with this existing large-scale industry for the daytime and night-time scenario. Partial vegetation loss to Long Strip which is an important landscape feature, however, given the scale and nature of the industrial context the loss of trees would not materially change the nature of landscape/ visual effects. Due to presence of large-scale structures within this LLT, and the nature of the proposals, it is assessed that the Project will have a limited potential to affect the landscape character and perception of the characteristics. Small scale impacts over a medium geographical extent, long term and reversible, therefore the magnitude of change is assessed as **low**. This will result in a minor adverse not significant effect.	Low	Minor adverse (not significant)

Construction (and Decommissioning)

13.8.9 The Project will result in significant effects at a site level as a result of construction activity, use of farmland for temporary laydown and removal of vegetation. No other significant effects are anticipated to the identified landscape and seascape receptors during construction (or decommissioning of the terrestrial elements of the project and infrastructure on the topside of the jetty).

Operation

13.8.10 During the Project's operational phase, the aesthetic and perceptual qualities would remain similar to the present, with large-scale static structures visible within the wider landscape. Due to the setting of the Project, it is assessed that there would be minor adverse effect to the existing landscape character at a local scale and a negligible effect at a regional or national scale.

13.8.11 Overall, the influence of the Project would be limited to the localised landscape immediately adjacent to the Site Boundary and therefore no significant landscape or seascape effects are identified.

13.8.12 Given the scale and nature of the Project, there is limited potential for mitigation measures to further reduce operational phase effects, however, where possible and within the constraints of the Project, landscape elements are proposed which would assist in integrate the Project into the receiving landscape. Further detail is included within the **Outline LEMP [TR030008/APP/6.9]**. The Outline LEMP defines the opportunities which are available within the operational site boundaries to provide a strategy for landscape and biodiversity enhancement.

Visual Effects

13.8.13 Potential visual effects in relation to the Project in comparison with the future baseline visual context are considered in **Table 13-9** by reference to representative viewpoints – this table considers both Project construction and operation (with construction phase effects also being applicable to the decommissioning phase) and taking embedded mitigation into account. The assessments contained within **Table 13-9** should be read in conjunction with **Figures 13.1** - **13.8 [TR030008/APP/6.3]** which illustrate the baseline situation at each viewpoint.

13.8.14 Ten residential properties on the west side of Queens Road are proposed to be acquired to facilitate the Project (also refer to **Chapter 2: The Project [TR030008/APP/6.2]**). Air Products (BR) Limited is in discussions with the landowners/occupiers of the residential properties on Queens Road to negotiate their acquisition. Where it is not possible to acquire those properties through negotiation, acquisition powers for these properties will be sought through the DCO. For the purposes of this assessment, residential receptors have been assessed as a group within Viewpoint 11 for the construction phase of the Project only.

Table 13-9: Viewpoint Assessment

Viewpoint 1: PRoW PAULF06/ Cherry Cobb Sands Road				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
523506, 418907	Users of the PRoW (recreational)	1.15	3.5	South-west
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
Extensive and open view containing many dynamic elements including large shipping vessels. Distant views of heavy industry including large structures and tall elements. View has scenic quality due to the scale of the view and receptors are focused on the surroundings. The susceptibility is assessed to be medium.		Medium		Medium
Size/ scale, duration and reversibility of impact at construction				
Distant views of construction activity associated with the Project would be visible across the Humber Estuary. At the time of the survey, a large shipping vessel associated with the Oil Terminal obstructed views of the Site. The Site occupies a narrow field of view within an extensive and almost continuous line of industrial development along the southern coastline and construction activities are unlikely to be obvious within the view. High level construction activity, such as cranes, are likely to be visible within the view and would add additional vertical features and movement into the scene. Construction of the jetty (including dredging) is also likely to be visible, although periodically screened by the vessels. Construction of low-level landside infrastructure and pipelines is anticipated to be partially screened from view by intervening vegetation, built form and shipping activities. Due to the existing context, construction activity is unlikely to be prominent to the casual observer and would not introduce features at odds with the existing landscape character as port cranes already exist within the view. The scale of the impact is small within the view; however, the nature of the impact is adverse. Construction activity would be phased with the majority of the works described above occurring during Phase 1 (predicted to last a duration of three years). The duration is therefore short term. The overall impact at construction is assessed as a small size/scale of change in the view, over a small geographical extent, short term and reversible and therefore a low magnitude. The sensitivity is assessed as medium and therefore, this would result in a minor adverse effect on visual amenity at this location.				
Magnitude of impact at construction				Low
Significance of effect at construction		Recreational		Minor adverse (not significant)

Viewpoint 1: PRoW PAULF06/ Cherry Cobb Sands Road		
Size/scale, duration and reversibility of impact at operation		
During Project operation, the in-river jetty including the marine infrastructure and the ammonia storage tank (located at the East Site) would be visible on the mid-horizon. Larger structures, including flare stack(s) and the ammonia storage tank would be visible against the sky. Additional large shipping vessels would be visible; however, these may also screen parts of the Project and would add movement within the Humber Estuary. The Project would increase the industrial prominence along the coastline without altering the balance of the overall view. The addition of the elements as described would not alter the character of the view due to the existing industrial context. The scale of the impact is small within the view; however, the nature of the impact is adverse. The impact of the Project would be long term and reversible for landside infrastructure and long term and permanent for marine infrastructure. The overall impact at operation is assessed as a small size/scale of change in the view, over a small geographical extent, long term and reversible and therefore a low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a minor adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Low
Significance of effect at operation	Recreational	Minor adverse (not significant)

Viewpoint 2: PRoW and proposed England Coast Path				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
521648, 415263	Recreational users of PRoW (recreational)	4.7	4.79	West
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
View containing dynamic elements associated with the Port and subject to natural coastal processes. Industrial presence and flood defences influence the view. Views contain an undeveloped arable field and mature woodland belt, which are located within the Site Boundary. The susceptibility is assessed to be medium.		Medium.		Medium
Size/scale, duration and reversibility of impact at construction				
Phase 1 construction works for the Project would be visible at close to mid-range. The construction works for the Project would occupy a wide field of view, with the proposed jetty and topside				

Viewpoint 2: PRoW and proposed England Coast Path		
infrastructure extending into the Humber to the north-east and the East Site (including the ammonia tank) located behind the trees to the west. High level construction activity, such as cranes for installations within the East Site are likely to be visible within the view and would add additional vertical features and movement into the scene. Elements such as this are already present within the view, however, these new features would be brought closer to the observer. The construction of the marine infrastructure (Work No. 1), including dredging, would be present within the foreground and further erode tranquillity within this localised area. It is anticipated that jack-up barge(s) and other marine construction vessels would be required to facilitate the construction of the jetty and would introduce a working offshore platform and further movement and disturbance into the coastal scene. Construction of the pipelines and jetty access road (Work No. 2) would also be visible from this location and would require removal of a section of the Long Strip woodland. In addition, site fencing and welfare facilities may also be present within the foreground. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. The alterations would result in a pronounced deterioration in the existing view; therefore, the nature of the impact is adverse. The overall impact at construction is assessed as a large size/scale of change in the view, over a large geographical extent, short term and reversible (with the exception of the tree removal) and therefore a high magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a major adverse effect (which is significant) on visual amenity at this location.		
Magnitude of impact at construction		High
Significance of effect at construction	Recreational	Major adverse (significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank, and structures associated with East Site are expected to be visible from this location and form dominant new features across the skyline. A section of the existing Long Strip woodland along the bridleway/PRoW would be removed to facilitate the operational access route to the jetty and pipe-racks, however some woodland would be retained which would provide some screening for views from the east. The jetty would be visible from this location, although would not add a feature not already present or characteristic of the view. Additional shipping vessels would add further movement to the already dynamic coastline. The ammonia pipeline from the jetty to the East Site is proposed to be above ground and stacked vertically. Views of this pipeline are likely to be visible from this location. The alterations would result in a noticeable deterioration in the view and therefore the nature of the impact is adverse. Users of the PRoW would experience transient views whilst using the PRoW, where the effects would be less visible along the wider route as a result of distance, intervening features, and direction of view.		

Viewpoint 2: PRoW and proposed England Coast Path		
The overall impact at operation is assessed as a medium size/scale of change in the view, over a medium geographical extent, long term and reversible (landside) (with the exception of the tree removal) and permanent (marine) and therefore a medium magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a moderate adverse effect (which is significant) on visual amenity at this location.		
Magnitude of impact at operation		Medium
Significance of effect at operation	Recreational	Moderate adverse (significant)

Viewpoint 3: PRoW Bridleway 36 and proposed England Coast Path				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
521311, 415505	Recreational users of the bridleway/ PRoW	5.5	Adjacent to the Site Boundary	South-east
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
View containing dynamic elements associated with the Port and subject to natural coastal processes. Industrial presence such as the Stallingborough chemical plant and flood defences influence the view. The view has a scenic quality albeit the detracting features. The susceptibility is assessed to be medium.		Medium		Medium
Size/scale, duration and reversibility of impact at construction				
Views of construction activity associated with the Project would be visible at close to mid-range. The Project would occupy a wide field of vision within this view, with the proposed jetty extending into the Humber to the north-east. The section of Bridleway 36 which runs along the eastern edge of the Long Strip woodland would be diverted during Phase 1 of the construction phase to enable a temporary construction area (Work No. 9) to be established. The assessment considers the proposed diversion of the route to the east of the Laporte Road Temporary Construction Area (Work No. 9), noting that the final route is not fixed (as shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**). The Bridleway would then re-open after the first phase of construction. High level construction activity, such as cranes for installations within the East Site are likely to be visible and would add additional vertical features and movement into the scene. The construction of the marine infrastructure, including dredging, would be present within the view and further erode tranquillity within this localised area. It is anticipated that jack-up barge(s) would be required to facilitate the construction of the jetty and would introduce a working offshore platform with further movement and disturbance into the coastal scene.				

Viewpoint 3: PRoW Bridleway 36 and proposed England Coast Path		
Construction of the pipelines and access road would be visible from this location and include tree loss within the Long Strip woodland. Additional impacts arising from the clearance of surface vegetation and digging of open trenches within the field to the foreground. In addition, site fencing and welfare facilities may also be present within the scene. Construction activity is likely to dominate the scene. As described above, the Bridleway 36 would be diverted during Phase 1 of the construction of the Project for safety reasons. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. The overall impact at construction is assessed as a large size/scale of change in the view, over a large geographical extent, short term and reversible (with the exception of the tree removal) and therefore a high magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a major adverse effect (which is significant) on visual amenity at this location.		
Magnitude of impact at construction		High
Significance of effect at construction	Recreational	Major adverse (significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank, and structures associated with the East Site (Work No. 3 and Work No. 5) are expected to be visible from this location on the periphery of the view. Some of the existing woodland along the Bridleway would be retained which would allow for some screening of the industrial installations. The new jetty (Work No. 1) would be visible from this location, alongside the existing IOT jetty. Additional shipping vessels would add further movement and disturbance to the already dynamic coastline. The temporary construction area (Work No. 9) in the arable field shown within the foreground would be restored to arable use following the construction of Phase 1 of the Project. The impact of the Project is long term and reversible for landside infrastructure and long term and permanent for marine infrastructure. The Project would result in a noticeable deterioration in the view and the nature of the impact is assessed as adverse. The viewpoint represents the worst-case scenario and is located at the closest point to the Project. Recreational receptors would experience transient views whilst using the PRoW, where the effects would be less visible as a result of intervening features and direction of view. The view from this location is likely to be orientated towards the Humber Estuary and activity associated with it. The overall impact at operation is assessed as a medium size/scale of change in the view, over a medium geographical extent, long term and reversible and therefore a medium magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a moderate adverse effect (which is significant) on visual amenity at this location.		
Magnitude of impact at operation		Medium
Significance of effect at operation	Recreational	Moderate adverse (significant)

Viewpoint 4: Queen's Road				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
520221, 414743	Motorised users of the road and commercial receptors.	2.2	Less than 0.1km from the Site Boundary	Viewpoint 4a – north-east. Viewpoint 4b – south-west.
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
View along Queen's Road containing both rural and urban elements. Detracting features such as Queen's Road Power Station. Receptors assessed as having a low susceptibility to change. The susceptibility is assessed to be low.		Low.		Low
Size/scale, duration and reversibility of impact at construction				
Views of construction activity associated with the Project would be visible at close to mid-range. The Project would occupy a wide field of vision within this view to the north-east and south-west. High level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) would be visible behind the trees and against the skyline. Lower-level construction activity associated with the East Site is likely to be screened by existing intervening vegetation. Construction activity associated with the West Site (Work No. 7) and hydrogen pipeline is likely to be noticeable within the view with machinery, site welfare cabins, fencing and heavy vehicles present within the foreground. The construction of the marine infrastructure is unlikely to be visible from this location. Construction activities are likely to result in a noticeable deterioration in the view and the nature of the impact is assessed as adverse. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. The overall impact at construction is assessed as a medium size/scale of change in the view, over a medium geographical extent, short term and reversible and therefore a medium magnitude. The sensitivity is assessed as low and therefore, the Project would result in a minor adverse effect (which is not significant) on visual amenity at this location.				
Magnitude of impact at construction				Medium
Significance of effect at construction		Local road users and commercial		Minor adverse (not significant)
Size/scale, duration and reversibility of impact at operation				
Installations, such as the ammonia tank (Work No. 3A), and other structures associated with East Site (Work No. 3 and Work No. 5) are expected to be visible from this location and would be visible on the skyline.				

Viewpoint 4: Queen's Road		
Installations associated with the West Site (Work No. 7) are also likely to be visible from this location to the south west. The Project would introduce large new structures into the scene which would increase the industrial presence within this localised area. The Project is not out of context within the receiving landscape, however, would introduce built form which would enclose the view to the south-west. The Project is likely to result in a deterioration in the view with the addition of large detracting elements. The impact of the Project is long term, reversible and adverse. The overall impact at operation is assessed as a small size/scale of change in the view, over a medium geographical extent, long term and reversible and therefore a medium magnitude. The sensitivity is assessed as low and therefore, the Project would result in a minor adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Medium
Significance of effect at operation	Local road users and commercial	Minor adverse (not significant)

Viewpoint 5: Public Right of Way to the east of Immingham				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
519289, 414779	Users of the Public Right of Way	2.12	0.5km	East
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
PRoW crosses a small to medium sized arable field. Detracting features present within the scene include overhead pylons, industrial building and power station. Receptors are assessed as having a medium susceptibility to the changes arising from the Project.		Low		Medium
Size/scale, duration and reversibility of impact at construction				
Views of high-level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) and West Site (Work No. 7) would be visible behind the trees on the horizon. Lower-level construction activity associated with the West Site is likely to be screened by existing intervening vegetation along King's Road (A1173). Low-level construction activity associated with the East Site, marine infrastructure and pipelines is unlikely to be visible from this location due to the distance of the receptor and intervening vegetation and surface features. The addition of cranes into the landscape would add to the existing vertical and detracting features, however, would remain in context with the landscape character.				

Viewpoint 5: Public Right of Way to the east of Immingham		
Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activities are likely to result in a limited deterioration of the view, however, the nature of the impact is adverse. The overall impact at construction is assessed as small size/scale of change in the view, over a small geographical extent, short term and reversible and therefore a low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a minor adverse effect on visual amenity at this location.		
Magnitude of impact at construction		Low
Significance of effect at construction	Recreational	Minor adverse (not significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank (Work No. 3A) , and structures associated with East Site (Work No. 3 and Work No. 5) are expected to be visible on the skyline. Installations associated with the West Site are also likely to be visible from this location. Together these would extend the existing vertical features across the skyline. The Project would introduce additional large new structures into the scene which would increase the industrial presence within this localised area. The Project is not out of context within the receiving landscape, however, would extend the existing detracting features across the horizon. The impact of the Project is long term and reversible. The Project is likely to result in a limited deterioration of the view, however, the nature of the impact is adverse. The overall impact at operation is assessed as a small size/scale of change in the view, over a small geographical extent, long term and reversible and therefore a low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a minor adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Low
Significance of effect at operation	Recreational	Minor adverse (not significant)

Viewpoint 6: Public Right of Way to the rear of Ings Lane/Talbot Road				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
519048, 414526	Residents	1.98	0.7km	North-east

Viewpoint 6: Public Right of Way to the rear of Ings Lane/Talbot Road		
Visual susceptibility to change	**Value of view**	**Sensitivity of receptor**
PRoW located to the rear of houses on Ings Lane and Talbot Road. The susceptibility of the receptor is assessed to be medium to high.	Low	Medium
Size/scale, duration and reversibility of impact at construction		
Views of high-level construction activity, such as cranes for installations within the East Site and West Site may be partially visible behind the trees on the horizon. Lower-level construction activity associated with the East Site and West Site would be screened by existing intervening vegetation including a block of woodland. All construction activity associated with the marine infrastructure and pipeline is unlikely to be visible from this location due to the distance of the receptor and intervening vegetation and surface features. The addition of cranes into the landscape would contribute additional vertical and detracting features into the scene, however, these are in context with the landscape character. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activity is likely to result in a change barely perceptible within the view. The overall impact at construction is assessed as small size/scale of change in the view, over a very small geographical extent, short term and reversible (with the exception of the tree removal) and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at construction		Very low
Significance of effect at construction	Residential and recreational	Negligible adverse (not significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank, and taller structures associated with East and West Site would be partially visible on the skyline, however, intervening vegetation would assist in screening some of these elements. The Project would introduce large new structures into the scene, although these may not be immediately apparent to the casual observer due to the proximity of the receptor from these structures. The Project is not out of context within the receiving landscape, however, would increase the presence of detracting features within the horizon where views allow. The impact of the Project is long term and reversible. The Project is likely to result in a barely perceptible deterioration of the existing view, however, the nature of the impact is assessed as adverse. The overall impact at operation is assessed as a small size/scale of change in the view, over a very small geographical extent, long term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		

Viewpoint 6: Public Right of Way to the rear of Ings Lane/Talbot Road		
Magnitude of impact at operation		Very Low
Significance of effect at operation	Residential and recreational	Negligible adverse (not significant)

Viewpoint 7: Public Right of Way to the north east of Mauxhall Farm				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
519090, 413323	Users of PRoW/recreational	3.2	1.2km	North-east
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
PRoW located within large arable fields. The susceptibility of the receptor is assessed to be medium to high as attention is focused on the enjoyment of the countryside.		Low		Medium
Size/scale, duration and reversibility of impact at construction				
Views of high-level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) and West Site (Work No. 7) are likely to be visible within the horizon. Lower-level construction activity associated with the West Site would be screened by existing intervening vegetation and built form. All construction activity associated with the marine infrastructure Work No. 1) and pipe-rack and jetty access road (Work No. 2) is unlikely to be visible from this location due to the distance of the receptor and intervening vegetation and surface features. The addition of cranes into the landscape would contribute additional vertical and detracting features into the scene, however, these are in context with the landscape character. Within the narrow field of vision, where the Project would be visible, there are existing overhead pylons and vertical features. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activity is likely to result in a change barely perceptible within the view. The overall impact at construction is assessed as a small size/scale of change in the view, over a very small geographical extent, short term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.				
Magnitude of impact at construction				Very Low
Significance of effect at construction	Residential			Negligible adverse (not significant)

Viewpoint 7: Public Right of Way to the north east of Mauxhall Farm		
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank (Work No. 3A), and taller structures associated with East Site (Work No. 3 and Work No. 5) and West Site (Work No. 7) have the potential to be partially visible on the skyline within a narrow extent along the horizon. The Project would introduce large new structures into the scene, although these may not be immediately apparent to the casual observer due to the proximity of the receptor from these structures. The Project is not out of context within the receiving landscape, however, the presence of detracting features within the horizon would be increased. The impact of the Project is long term and reversible. The Project is likely to result in a barely perceptible deterioration of the existing view. The overall impact at operation is assessed as a small size/scale of change in the view, over a very small geographical extent, long term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Very Low
Significance of effect at operation	Residential	Negligible adverse (not significant)

Viewpoint 8: Public Right of Way to the north east of Stallingborough				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
520649, 412061	Users of PRoW and residents	1.8	2.4km	North
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
PRoW located within large arable fields with scattered areas of scrub and some mature trees along boundaries. Receptors have open rural views, however, influenced by pylons and distant industry on the horizon. The susceptibility of the receptor is assessed to be medium to high.		Low		Medium
Size/scale, duration and reversibility of impact at construction				
Views of high-level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) and West Site (Work No. 7) are likely to be visible behind mature vegetation on the horizon. Lower-level construction activity associated with the Project would be screened by existing intervening vegetation and built form.				

Viewpoint 8: Public Right of Way to the north east of Stallingborough		
All construction activity associated with the marine infrastructure and pipeline is unlikely to be visible from this location due to the distance of the receptor and intervening vegetation and surface features. The addition of cranes into the landscape would contribute additional vertical and detracting features into the scene, however, these are in context with the landscape character. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activity is likely to result in a change barely perceptible within the view. The overall impact at construction is assessed as a small size/scale change in the view, over a very small geographical extent, short term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at construction		Very Low
Significance of effect at construction	Residential and recreational	Negligible adverse (not significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank, and taller structures associated with East and West Site have the potential to be partially visible on the skyline although mature intervening vegetation would screen a large proportion of the Project. The Project would introduce large new structures into the scene, although these may not be immediately apparent to the casual observer due to the distance proximity of the receptor from these structures and the scale of other detracting features closer to the receptor. The Project is not out of context within the receiving landscape, however, the presence of detracting features within the horizon would increase. The impact of the Project is long term and reversible. The Project is likely to result in a barely perceptible deterioration of the existing view. The overall impact at operation is assessed as a small size/scale of change in the view, over a very small geographical extent, long term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Very Low
Significance of effect at operation	Residential and recreational	Negligible adverse (not significant)

Viewpoint 9: B1210 adjacent to railway line				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
518447, 412430	Users of the local road	3.6	2.4km	North
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
Road travelling across the railway bridge, but otherwise through a flat landscape with open views across large former arable fields. Vegetation cover is generally low. Overhead wires and pylons traverse the landscape and various industrial facilities, and mature trees enclose the horizon. The susceptibility of the receptor is assessed to be low.		Low		Low
Size/scale, duration and reversibility of impact at construction				
Views of high-level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) and West Site (Work No. 7) are likely to be visible behind mature vegetation and existing structures on the horizon. Lower-level construction activity associated with the Project would be screened by existing intervening vegetation and built form. All construction activity associated with the marine infrastructure (Work No. 1) is unlikely to be visible from this location due to the distance of the receptor and intervening vegetation and surface features. The addition of cranes into the landscape would contribute additional vertical and detracting features into the scene, however, these are in context with the landscape character. Construction activity would be phased with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activity is likely to result in a change barely perceptible within the view. The overall impact at construction is assessed as a small size/scale of change in the view, over a very small geographical extent, short term and reversible and therefore a very low magnitude. The sensitivity is assessed as low and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.				
Magnitude of impact at construction				Very Low
Significance of effect at construction		Road users		Negligible adverse (not significant)
Size/scale, duration and reversibility of impact at operation				
Installations, such as the ammonia tank, and taller structures associated with East and West Site have the potential to be partially visible on the skyline although mature intervening vegetation would screen a large proportion of the development. The Project would introduce large new structures into the scene, although these may not be immediately apparent to the casual observer due to the proximity of the receptor from these				

Viewpoint 9: B1210 adjacent to railway line		
structures and the scale of the development in relation to similar developments. The Project is not out of context within the receiving landscape, however, the presence of detracting features within the horizon would increase. The impact of the Project is long term and reversible. The Project is likely to result in a barely perceptible deterioration of the existing view. The overall impact at operation is assessed as a small size/scale of change in the view, over a very small geographical extent, long term and reversible and therefore a very low magnitude. The sensitivity is assessed as low and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Very Low
Significance of effect at operation	Road users	Negligible adverse (not significant)

Viewpoint 10: Public Right of Way and proposed England Coast Path				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
518160, 417989	Users of the PRoW	3.6	3.5km	South-east
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
Users of the coastal path travelling south along the flood defences. Views are open and extensive across the Humber Estuary. Industry both marine and landside is dominant and erodes tranquillity. The susceptibility of the receptor is assessed to be medium due to the nature of the views.		Low		Medium to low
Size/scale, duration and reversibility of impact at construction				
Views of high-level construction activity, such as cranes for installations within the East Site (Work No. 3 and Work No. 5) and for the marine infrastructure (Work No. 1) have the potential to be visible behind the existing structures associated with the Oil Terminal. Lower-level construction activity associated with the Project would be screened by built form and intervening vegetation. Construction activity associated with the pipelines would not be visible due to large intervening surface features. The addition of cranes into the landscape would contribute additional vertical and detracting features into the scene, however, these are in context with the landscape character and would not be discernible within the existing context.				

Viewpoint 10: Public Right of Way and proposed England Coast Path		
Construction activity would be phased over with the majority of the works described above occurring during Phase 1 over a period of three years. The duration is therefore short term. Construction activity is likely to result in a change barely perceptible within the view. The overall impact at construction is assessed as a small size/scale of change in the view, over a small geographical extent, short term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium to low and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at construction		Very Low
Significance of effect at construction	Recreational	Negligible adverse (not significant)
Size/scale, duration and reversibility of impact at operation		
Installations, such as the ammonia tank (Work No 3A), and other taller structures associated with the East Site (Work No. 3 and Work No. 5) have the potential to be visible on the skyline although existing intervening mature vegetation would screen a large proportion of the Project. The Project would introduce large new structures into the scene, although these may not be immediately apparent to the casual observer due to the presence of similar industrial elements across the view. The Project is not out of context within the receiving landscape. The impact of the Project is long term and reversible. The Project is likely to result in a barely perceptible deterioration of the existing view. The overall impact at operation is assessed as a small size/scale, over a small geographical extent, long term and reversible and therefore a very low magnitude. The sensitivity is assessed as medium to low and therefore, the Project would result in a negligible adverse effect on visual amenity at this location.		
Magnitude of impact at operation		Very Low
Significance of effect at operation	Recreational	Negligible adverse (not significant)

Viewpoint 11: Kings Road				
Grid reference	**Receptor type**	**Elevation (m AOD)**	**Approx. distance from Project (km)**	**Direction of view**
519676 414814	Residents of properties on Queens Road	2	>10m	East
Visual susceptibility to change		**Value of view**		**Sensitivity of receptor**
Residential receptors located at close proximity to the West Site. Views of the Project are likely from first floor windows and principle living areas in locations where intervening boundary features do not exist.		Low		Medium

Viewpoint 11: Kings Road		
It is assessed that the susceptibility of the residential receptors is high due to the nature of the receptor and proximity to the Project. It is expected that these residential receptors will be acquired to facilitate the Project.		
Size/scale, duration and reversibility of impact at construction		
Potential views of construction activity associated with the West Site (Work No. 7) are expected to be visible at close to mid-range and would extend across the entire view to the rear of the residential receptors. High-level construction activity associated with the East Site (Work No 3. and Work No. 5) may be visible in the distance to the north, and construction activity associated with the pipeline may be visible east where there are no intervening landscape elements or built form. Construction activity associated with the West Site (Work No. 7) is likely to be noticeable within the view to the rear of the residences with machinery, site welfare cabins, fencing and heavy vehicles present within the foreground. Pipeline construction may include the clearing of surface vegetation and the digging of open trenches within the field to the foreground, however, details are yet to be confirmed. Construction activity would be phased with the majority of the works occurring during Phase 1 over a period of three years. Construction activity during Phases 2 to 6 occur over a seven-year period and include the additions of converters and liquefiers within the East and West Sites. The duration is therefore short term. Construction activities are likely to result in a noticeable deterioration in the view to the west of the residential receptors over a large area and at close proximity to the receptor. The nature of the impact is assessed as adverse. The overall impact at construction is assessed as a large size/scale change in the view, over a large geographical extent, short term and reversible and therefore a high magnitude. The sensitivity is assessed as medium and therefore, the Project would result in a major adverse effect (which is significant) on visual amenity at this location.		
Magnitude of impact at construction		High
Significance of effect at construction	Residential	Major adverse (significant)

Construction (and Decommissioning)

13.8.15 During Project construction (and decommissioning of the hydrogen production facility) there would be changes in the view through the addition of detracting visual features associated with the construction process, visual disturbance, and the progressive introduction of new large-scale structures at various stages of development. The visual effects at the construction stage are assessed to be short term and reversible.

13.8.16 As detailed in **Table 13-9**, the assessment indicates that potential significant adverse visual amenity effects could be experienced at a number of representative viewpoints as follows during the construction phase:

a. Viewpoint 2 (PRoW and proposed England Coast Path), major adverse significant effect.

b. Viewpoint 3 (PRoW and proposed England Coast Path), major adverse significant effect.

c. Viewpoint 11 (Residential receptors located on Queens Road), major adverse significant effect.

Operation

13.8.17 The visibility of the Project across a large extent of the study area is likely due to limited intervening vegetation and built form within a flat landscape. The Project would introduce new, large structures and vertical elements into a landscape where these features are already present. When viewed from within the landscape, these new structures would be viewed within the context of existing similar structures within relatively close range.

13.8.18 The introduction of this industrial development within a substantial landscape framework would not be uncharacteristic when set within the existing attributes of the local receiving landscape. This includes the existing development and infrastructure.

13.8.19 The visual effects at operation are assessed to be long term and reversible for landside infrastructure and permanent for marine infrastructure.

13.8.20 As detailed in **Table 13-9**, the assessment indicates that potential significant adverse visual amenity effects could be experienced at a number of representative viewpoints as follows during the operational phase:

a. Viewpoint 2 (PRoW NKIL50 and proposed England Coast Path), moderate adverse significant effect.

b. Viewpoint 3 (PRoW Bridleway 36 and proposed England Coast Path), moderate adverse significant effect.

13.9 Mitigation and Enhancement Measures

13.9.1 Major adverse (significant) visual amenity effects have been assessed for Viewpoint 2 (PRoW NKIL50 Proposed England Coast Path) and Viewpoint 3 (PRoW Bridleway 36 and Proposed England Coast Path) for PRoW users during construction and moderate adverse (significant) visual effects at operation of the Project. Major adverse (significant) visual amenity effects have been assessed for Viewpoint 11 (Queens Road) for residential receptors during construction. No further significant effects have been assessed for the Project during construction or operation.

13.9.2 The opportunity for mitigation of the visual effects of the Project at Viewpoint 2 and Viewpoint 3 is limited due to the size and scale of the Project. It is considered that the addition of landscape features such as trees and woodland would not be effective in reducing these effects on visual amenity.

13.9.3 The final finishes of the buildings and structures and exact sizes of component parts will not be finalised until the final detailed design is complete.

13.9.4 An **Outline Woodland Compensation Strategy [TR030008/APP/6.8]** has been prepared. This Strategy sets out the approach which will be used to compensate for the tree loss from the Long Strip woodland. The approach is to provide compensatory tree planting, in accordance with local guidance, within a defined area within ABP's wider Immingham port estate. Implementation of the strategy would be secured by a Requirement of the **draft DCO [TR030008/APP/2.1]**.

13.10 Assessment of Residual Effects

13.10.1 The assessment has determined that receptors at Viewpoints 2, 3 and 11 are likely to experience significant short-term adverse effects during the construction phase of the Project as a result of the close distance to the proposed infrastructure and limited intervening vegetation.

13.10.2 Effects are assessed to remain significant during operation for receptors at Viewpoints 2 and 3 due to the sensitivity of these receptors (recreational) and the close distance of these receptors to the Project. Viewpoints 2 and 3 are located within a short distance from each other and represent the worst-case scenario for transient views experienced by recreational receptors using the proposed England Coast Path and bridleway.

Table 13-10: Summary of potential impact, mitigation measures and residual effects

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
Construction	Impact on landscape character to the Site and its immediate setting	Moderate adverse (significant)	None	Moderate adverse (significant)	St/T
Construction	Impact on recreational users at viewpoint 2 PRoW and proposed England Coast Path Route	Major adverse (significant)	None	Major adverse (significant)	St/T
Construction	Impact on recreational users at viewpoint 3 bridleway/ PRoW and proposed England Coast Path Route	Major adverse (significant)	None	Major adverse (significant)	St/T
Construction	Impact on residential receptors located on Queens Road at viewpoint 11	Major adverse (significant)	None	Major adverse (significant)	St/T

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
Operation	Impact on recreational users at viewpoint 2 PRoW and proposed England Coast Path Route	Moderate adverse (significant)	None	Moderate adverse (significant)	Lt/T
Operation	Impact on recreational users at viewpoint 3 bridleway/ PRoW and proposed England Coast Path Route	Moderate adverse (significant)	None	Moderate adverse (significant)	Lt/T
* Long term (Lt)/Medium term (Mt)/Short term (St) and Permeant (P)/Temporary (T) and Direct (D)/Indirect (In)					

13.11 Summary of Assessment

Landscape and Seascape Effects

13.11.1 The landscape and seascape effects have been assessed at national, regional, local and Site level and are described in full in **Table 13-7** for the construction and decommissioning phase of the Project and in **Table 13-8** for the operational phase of the Project.

Construction

13.11.2 The identified landscape and seascape effects range from negligible or minor adverse (for national, regional, and local landscape receptors) to moderate adverse for effects at the Site level. The Project is expected to result in significant landscape effects at the Site level as a result of construction activity, use of farmland for temporary laydown and the removal of vegetation including sections of Long Strip.

13.11.3 No other significant effects are anticipated to the identified landscape and seascape receptors during construction (and decommissioning) of the Project due to the existing industrial context and ongoing port activity.

Operation

13.11.4 During Project operation, the aesthetic and perceptual qualities would remain similar to the present, with large-scale static structures visible within the wider landscape. Due to the setting of the Project, it is assessed that the effects would result in a minor adverse effect to the existing landscape character at a local scale and a negligible effect at a regional or national scale.

13.11.5 Overall, the influence of the Project would be limited to the localised landscape immediately adjacent to the Site Boundary and therefore no significant landscape or seascape effects are identified.

Visual Effects

13.11.6 The visual effects were assessed at 11 viewpoints and represent the likely views experienced by a range of visual receptors, including residential, recreational, commercial, and road users. The visual effects are described in detail within **Table 13-10**.

Construction

13.11.7 During Project construction (and decommissioning of the hydrogen production facility) there would be changes to views through the addition of detracting visual features associated with the construction process, visual disturbance, and the progressive introduction of new large-scale structures at various stages of development. The removal of vegetation including sections of Long Strip would open localised views of construction activity. This would result in short-term significant adverse effects at three representative viewpoints. Short term significant visual effects for the construction phase would be limited to viewpoints located adjacent to the Site Boundary.

Operation

13.11.8 During the operational phase of the Project, the visual influence of the Project would be limited to the localised landscape immediately adjacent to the Site Boundary. This would result in long term significant effects for receptors at two representative viewpoints where recreational receptors have been identified.

13.11.9 The impacts assessed for viewpoints located further from the Site Boundary range between negligible and minor adverse due to intervening vegetation and built form and the Project's location in context with existing detracting features within the industrial landscape.

13.12 References

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Ref 13-18 Google Earth.

Ref 13-19 Google Street View.

Ref 13-20 MAGIC open source data.

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Ref 13-32 FPCR, Environment and Design Ltd (2015). North East Lincolnshire Landscape Character Assessment Sensitivity and Capacity Study.

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Ref 13-34 DEFRA (2009). Construction Code of practice for the Sustainable Use of Soils.

Ref 13-35 The British Standard (2012). Trees in Relation to Design, Demolition and Construction to Construction - Recommendations (BS 5837).

Ref 13-36 JBA Consulting on behalf of North Lincolnshire Council (n.d.). North Lincolnshire Landscape Character Assessment – a review by JBA Consulting on behalf of North Lincolnshire Council (no publication date).

Ref 13-37 North East Lincolnshire Council (2010). Landscape Character Assessment.

Ref 13-38 Natural England (2021). England Coast Path Stretch: Mablethorpe to Humber Bridge. Report MHB 3: Humberston to Immingham Docks. Map MHB 3l: North Beck Drain to Queens Road.

Ref 13-39 National Forest (2018). National Forest Inventory Woodland Map.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 14: Historical Environment (Terrestrial)

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 14: Historic Environment (Terrestrial)

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

Table of contents

14 Historic Environment (Terrestrial)

14.1 Introduction

14.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on the historic environment (terrestrial). For more details about the Project, including construction methodology, layout and lifespan and defined Site areas, refer to **Chapter 1: Introduction** and **Chapter 2: The Project [TR030008/APP/6.2]**.

14.1.2 References to 'the Project' within this chapter relate to the landside (terrestrial) infrastructure components as detailed in **Section 2.4** of **Chapter 2: The Project**.

14.1.3 References to 'the Site' within this chapter relate to the areas of land encompassed by all terrestrial elements of the Project (the entire terrestrial Site Boundary of the Project). The Site location is shown on **Figure 1.1 [TR030008/APP/6.3]**, whilst **Figure 2.3 [TR030008/APP/6.3]** shows the Site plan for the Project, outlining the location of the West Site, Pipeline Corridor, East Site, Temporary Construction Areas (including a concrete batching plant on the East Site (Work No. 5a) and Jetty sites.

14.1.4 The Historic Environment (Marine) has been assessed and is reported separately in **Chapter 15: Historic Environment (Marine)** of this Environmental Statement ("ES") **[TR030008/APP/6.2]**.

14.1.5 As interrelationships exist between the potential effects on the historic environment (terrestrial) and certain other assessments, reference should be made to the following chapters of the ES **[TR030008/APP/6.2]**:

a. **Chapter 15: Historic Environment (Marine)**.

b. **Chapter 21: Ground Conditions and Land Quality**.

14.1.6 This chapter is based on research and evaluation works including a Cultural Heritage Desk-Based Assessment ("DBA", **Appendix 14.C [TR030008/APP/6.4]**) and a programme of archaeological evaluation undertaken across areas of the Site. The findings of these works have guided the baseline and impact assessment presented, helping to inform the understanding of the significance and setting of the heritage assets within the study area, and the impacts and effects that the Project may have upon them.

14.1.7 The chapter considers the future baseline , whereby changes to the status of heritage assets over time are identified in a scenario where the Project does not proceed.

14.1.8 Cultural heritage comprises all aspects of the historic environment resulting from the interaction and relationships between people and places through time. The above aspects are referred to as heritage assets: buildings, monuments, sites, places, areas or landscapes identified as having a degree of significance due to their heritage interest that merit consideration in planning decisions. Cultural heritage influences how people relate to places and cultures and can provide a sense of place and stability to a community.

14.1.9 Heritage assets are defined within the National Policy Statement for Ports ("NPSfP", Ref 14-8) as *"Those elements of the historic environment that hold value to this and future generations because of their historic, archaeological, architectural or artistic interest"* and that *"A Heritage Asset may be any building, monument, site, place, area or landscape or any combination of these".*

14.1.10 Heritage assets include those that are designated under legislation (such as listed buildings and scheduled monuments) as well as those that are non-designated. Non-designated heritage assets are assets that are considered to have a degree of local interest or significance usually recognised by local planning authorities ("LPAs"), either by their inclusion within the local Historic Environment Record ("HER") or by local listing.

14.1.11 This chapter:

a. Details the requirements of key legislative and policy requirements and describes how the Project and this assessment has considered them.

b. Explains how information on the existing and future historic environment has been collected (through desk-based studies, survey work and stakeholder consultation).

c. Describes the understanding of the existing and future historic environment, utilising the baseline information.

d. Explains any further information to be obtained through further consultation, desk-based studies or surveys.

e. Describes the likely significant effects of the Project on cultural heritage within the historic environment (terrestrial).

f. Describes the proposed mitigation measures.

g. Presents an assessment of residual effects, once the proposed mitigation measures have been taken into account.

14.1.12 This chapter is supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 14.1:** Location of designated heritage assets.

b. **Figure 14.2:** Location of non-designated heritage assets.

c. **Figure 14.3:** Historic Landscape Characterisation.

14.1.13 This chapter is also supported by the following appendices **[TR030008/APP/6.4]**:

a. **Appendix 14.A:** Historic Environment Events Register.

b. **Appendix 14.B:** Heritage Assets Register.

c. **Appendix 14.C:** Archaeology and Cultural Heritage Desk-based Assessment.

d. **Appendix 14.D:** Heritage Standards and Guidance.

e. **Appendix 14.E:** Written Scheme of Investigation for GI Watching Brief, Geoarchaeological Boreholes, Geophysical Survey and Archaeological Trial Trenching.

f. **Appendix 14.F:** Report on Trial Trench Evaluation.

g. **Appendix 14.G:** Report on Geoarchaeological Survey and monitoring of Geotechnical Investigations.

h. **Appendix 14.H:** Report on Geophysical Survey.

14.2 Consultation and Engagement

14.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the historic environment (terrestrial) assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on the historic environment (terrestrial). A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

14.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("the 2008 Act"). The Applicant (Associated British Ports) prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

14.2.3 As a result of consideration of the responses to the first Statutory Consultation, the developing environmental assessments and ongoing design-development and assessment, a series of changes to the Project were identified. A second Statutory Consultation took place between 24 May and 20 July in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

14.2.4 The consultations undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the first and second Statutory Consultations and other pre-application engagement are summarised in **Table 14-1** The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 14-1: Stakeholder Consultation

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report seeks to scope out this matter *[impacts on below ground archaeological remains during operation and decommissioning of the Project]* on the grounds that project operation and decommissioning would not result in additional impacts to buried archaeological remains to those experienced during construction. The Inspectorate agrees that this matter can be scoped out of the assessment.	Noted. No further comment needed.
		The Scoping Report seeks to limit the scope of the assessment of built heritage to the impacts on the setting of two non-designated rows of terraced housing on Queens Road, as other assets within the study area are sufficiently distant from the site and shielded by other development. In light of the evidence provided in Appendix D -Cultural Heritage Desk Based Assessment, the Inspectorate agrees with the proposed scope of the built heritage assessment.	Noted. No further comment needed.
		The Scoping Report seeks to limit the scope of the assessment of impacts to historic landscape character to the western fringe of the Proposed Development area. In light of the evidence provided in Appendix D -Cultural Heritage Desk Based Assessment, the Inspectorate agrees with the proposed scope of the built heritage assessment.	Noted. No further comment needed.
		The Scoping Report does not refer to decommissioning within its proposals for scoping in/out with respect to impacts on built heritage and historic landscape. Subject to the provision of the Outline Decommissioning Plan secured within the DCO to detail measures to avoid or reduce impacts on built	Noted. No further comment needed. Information from this Chapter regarding decommissioning (**Paragraphs 14.8.9 - 14.8.11**) is included within

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		heritage and historic landscape, the Inspectorate agrees to scope out this matter from the ES.	the **Outline Decommissioning Environmental Management Plan** ("Outline DEMP") **[TR030008/APP/6.6]**).
		The Scoping Report proposes a staged programme of archaeological evaluation, stating only that geophysical survey or evaluation trenching may be required. However, Appendix D paragraph 4.58 states that archaeological potential of the site is high for some features, and paragraph 6.6 recommends that archaeological evaluation is undertaken including geoarchaeological investigation and targeted trial trenching. The extent of survey activity should be agreed as part of a Written Scheme of Investigation with NELC, where possible. Where necessary intrusive investigations should be completed prior to submission of the DCO application.	A Written Scheme of Investigation ("WSI") was produced that sets out the scope of archaeological investigation to be completed prior to the submission of the application (**Appendix 14.E [TR030008/APP/6.4]**). This scope of works included Ground Investigation ("GI") watching brief, geoarchaeological borehole survey, trial trench evaluation and geophysical survey. This scope of works was agreed with the County Archaeologist and has been undertaken (reports on these works are attached as **Appendices 14.F** - **14.H [TR030008/APP/6.4]**).
		The Proposed Development has potential to alter drainage patterns and this could indirectly affect below ground heritage assets. The ES should provide commentary on the likelihood of indirect impacts on heritage assets to arise and outline any necessary mitigation measures to address significant effects where they are likely to occur.	A greater understanding of the ground make up and any archaeological features present has been obtained through the archaeological evaluation work undertaken. The results of this in relation to the potential impact upon below ground archaeological

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
			remains have been considered as part of the assessment.
		The Applicant's attention is drawn to the consultation response from Immingham Town Council regarding the historical value of 31 Queen's Road.	The PEI Report initially considered and reported on the historic value of assets at Queens Road including No 31 and the impact upon them. The properties have been reconsidered as part of this assessment (and in light of changes to the Project and its Site Boundary). This re-assessment has confirmed that the impact on the properties remains assessed as low.
Scoping Report August 2022	Historic England	We are in general agreement regarding the content of the Scoping Report (AECOM: August 2022) and the areas of the Historic Environment which are to be scoped in and out of the assessment. It is important to make sure that the area of the terrestrial and maritime heritage assessments abut or overlap so that no assets are missed and the setting of assets can be assessed as a whole.	Noted. An intertidal walkover survey was undertaken on 25 October 2022 in order to ensure baseline coverage of the intertidal zone has been considered for terrestrial and marine heritage aspects. There is an overlap between the terrestrial and marine areas. Information on how the terrestrial and marine assessments overlap is provided in **Paragraphs 14.6.71 - 14.6.74**.
		This development could, potentially, have an impact upon a number of designated and un-designated terrestrial and maritime heritage assets and their settings in the area around	The visibility of the Project has been taken into account when assessing impacts upon assets

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		the site. In line with the advice in the National Planning Policy Framework (NPPF), we would expect the Environmental Statement to contain a thorough assessment of the likely effects which the proposed development might have upon those elements which contribute to the significance of these assets. Given the heights of the structures associated with the proposed development and the surrounding landscape character, this development is likely to be visible across a very large area and could, as a result, affect the significance of heritage assets at some distance from this site itself. We would expect the assessment to clearly demonstrate that the extent of the proposed study area is of the appropriate size to ensure that all heritage assets likely to be affected by this development have been included and can be properly assessed.	within this chapter. This has assumed a worse case scenario i.e. maximum proposed heights where options have been presented and maximum visibility (i.e. screening from proposed other elements of the Project or other proposed development has not been taken into account) when determining which assets may be effected by the Project and when assessing what that impact may look like.
		It is important that the assessment is designed to ensure that all impacts are fully understood including associated activities (such as construction, servicing and maintenance, and associated traffic) might have upon perceptions, understanding and appreciation of the heritage assets in the area. Section drawings and techniques such as photomontages are a useful part of this. The likelihood of alterations to drainage patterns should also be considered as this may lead to in situ decomposition or destruction of below ground archaeological remains and deposits, and the subsidence of buildings and monuments. We would strongly recommend that you involve the Historic Environment Officers at North and North East Lincolnshire Councils in the development of this assessment. They are best placed to advise on: local historic environment issues and priorities; how the proposal can be tailored to avoid and minimise	The assessment has considered physical impacts upon assets and impacts on the setting of assets. The results of the archaeological evaluation work have informed the assessment of the potential for below ground remains (incorporated into the baseline assessment and assessment of effects) and the sensitivity of such remains. The Historic Environment Officer has been consulted at all stages of work, as appropriate.

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		potential adverse impacts on the historic environment; the nature and design of any required mitigation measures; and opportunities for securing wider benefits for the future conservation and management of heritage assets.	
Scoping Report August 2022	Immingham Town Council	One of the properties, 31 Queens Road, appeared to have some historical value to the area, as it is unique and was built for the Pastor of Seaman's Mission. This should be protected.	This ES chapter has considered these properties including No 31. The value of the assets remains assessed as low. The impact of the construction of the Project within the setting of the asset remains assessed as of medium magnitude, resulting in a minor adverse effect which is not significant.
August 2022	North East Lincolnshire Council ("NELC")	NELC is happy with the details set out in the scoping document.	Noted.
July 2022	Heritage Officer for NELC	Approval of DBA – via email.	Approved, minor comments addressed.
August 2022	Heritage Officer for NELC	Outline meeting for scope of fieldwork – via Teams meeting.	Scope approved in principle and actions (production of WSI etc.) agreed.
14 September 2022	Heritage Officer for NELC	Approval of Written Scheme of Investigation for monitoring of Geotechnical investigation, Geophysical survey, Geo-archaeological investigation and trial trench evaluation - via email.	Approved, minor comments addressed.

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
17 January 2023	Heritage Officer for NELC	Approval of Method Statements for Geophysical survey, Geo-archaeological investigation and trial trench evaluation – via email.	Approved, minor comments addressed.
21 November 2022 – 10 February 2023	Heritage Officer for NELC	Monitoring of field works and sign off of trial trench evaluation. Communication ongoing through this period (via phone calls and email). Comments resulted in minor trench relocation during works. Comments made via a combination of in person on site meetings, virtual meetings and emails over this period.	All field work approved and signed off (by the Heritage Officer for NELC) as complete
Statutory Consultation (PEIR) December 2022 – February 2023	Historic England	We note the proposed terrestrial and marine investigations. We consider it premature to conclude environmental impacts in respect of marine and/or terrestrial archaeology. Remains /wrecks can [be] classed as less than significant post-mitigation when sufficient survey and deposit modelling work [has not yet] been carried out/shared.	A programme of archaeological evaluation works was designed for the Site and has now been undertaken. The results of this work are incorporated into this document. As a result of this work, where applicable, new assets have been added, and the significance of assets re-evaluated.
		We note the submitted Written Scheme of Investigation for terrestrial works but would respectfully point out that this does not present the investigations proposed within a coherent staged strategy that would allow investigations and survey to effectively inform deposit modelling and mitigation through further intrusive investigations, supervision and recording etc.	The work to date has consisted of a number of stages, specifically: a. The production of the DBA (which incorporates the results of previous archaeological surveys conducted at the Site).

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
			b. A programme of archaeological field work which has included: i. Geoarchaeological evaluation (with the aim of creating a deposit model). ii. Archaeological Trial Trench evaluation. iii. Geophysical Survey. iv. Monitoring of GI works. The results of these stages of work are incorporated into this chapter and inform the necessity and scope of any further archaeological mitigation/ evaluation or other works required post consent.
		The strategy presented appears to unduly compress this [fieldwork] process thereby potentially undermining the management of archaeological and project risks.	The programme of works has been thorough in its design, implementation and aims (and has been approved by the Heritage Officer for NELC). The results of all of the works have been considered in this assessment including the assessment of impacts and the

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
			need for/nature of any further mitigation works.
		We note also that whilst the methods submitted are presented as a Written Scheme of Investigation this document is not produced by the actual contractors who would undertake the work and as such should be regarded as a consultant's archaeological strategy with the actual WSI's remaining for preparation and approval with reference to the expertise of the Local Authority archaeological curator.	a. The WSI was an overarching document which was designed to provide a high-level strategy for the works. b. This WSI was supported by individual method statements (prepared by the specialist sub contractors) for each piece of work. These provided the specific detail of the method and aims for each piece of work. c. The WSI and each method statement were approved by the Heritage Officer for NELC prior to the start of works on site. d. All works were undertaken as detailed within the WSI and Method Statements and signed off by the Heritage Officer for NELC.
		As noted in our scoping advice it is important to regard the divide between marine and terrestrial as only the present day boundary and for investigations across this to be well integrated reflecting the shifting relationship through past	The Marine Archaeological Assessment work is being undertaken by the same company which undertook the terrestrial

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		centuries and millennia in which deposits were formed. As regards marine survey we look forwards to seeing the results of geophysical survey and deposit modelling to provide a more informed understanding both of ancient deposits and remains and the location, significance and importance of wrecks. Again it appears premature to cap the potential impact of capital dredging before this work is done since only with a sound understanding of the resource potential can mitigation through exclusion areas, depth limits and excavation be modelled.	archaeological evaluation fieldwork - Wessex Archaeology. This aids with integration of the results and assessment and presentation of the data collected. AECOM are working closely and collaboratively with Wessex Archaeology to ensure an integrated approach has been taken for the ES, particularly with reference to the transitions between marine and terrestrial archaeology, which, as Historic England rightly point out, can be viewed only as the present-day boundary rather than being fixed throughout prehistoric and historic periods. Again, this is presented within the ES (**Chapter 15 [TR030008/APP/6.2]**).
Statutory Consultation (PEIR) January – February 2023	Heritage Officer for NELC	Currently archaeological investigation work is ongoing on this site, and will be for the next few weeks in order to gather the evidence base to further inform any heritage mitigation on this site. Until this work is complete I am not able to add anything further to my original comments.	Site works are now complete. Reports on this work, have been provided to the Heritage Officer for NELC. The recommendations for further work contained within this assessment are based on the evidence contained within these reports and have been agreed in liaison with the Heritage Officer for NELC.

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		The scope of works and proposed Heritage Assessment appears to be acceptable and I look forward to working with the applicants throughout the project.	Noted. Evaluation work now complete (July 2023).
Second Statutory Consultation May – July 2023	Historic England	We note the additional information that has been provided. This provides a greater degree of certainty with regards to potentially sensitive peat deposits (and similar) will be handled further down the line. With the GI investigations in the marine environment we are still uncertain about the impact on any unknown wrecks &c. However, if the applicant is confident that—based on the data they have gathered through marine geophysical surveys—they can undertake this work whilst avoiding impacts on aforementioned historic environment assets, then we have no objection to the approach set out (suitably secured by requirements).	Further investigation on the samples taken will be undertaken as set out in the mitigation section of this assessment and agreed with NELC.
	Lincolnshire Wildlife Trust	In Section 6.4.4, the Applicant quotes the PEIR which states that, 'In order to mitigate for tree loss from the Long Strip and elsewhere, the following approach is proposed: Tree planting within some peripheral areas around the operational sites of the hydrogen facility, although these opportunities will be very limited; and Opportunities to be explored for potential off-site tree-planting within areas to be agreed with local bodies/organisations' LWT would like to point out that the Applicant has provided two examples of non-localised compensation, rather than mitigation. Therefore, further due diligence towards the mitigation hierarchy is recommended, and the above examples should be considered last resorts, according to best practice. Simply put, this particular woodland is considered	In relation to the Heritage aspect of the woodland, it has been determined that the planned ecological surveys will also provide an adequate historic record. See **Appendix 8F: Arboricultural Impact Assessment [TR030008/APP/6.4]**) and the **Outline Construction Environmental Management Plan** ("Outline CEMP") **[TR030008/APP/6.5]** for details on proposed surveys.

Reference/ Date	Consultee	Comment	How comments have been addressed in this chapter
		irreplaceable and invaluable to local biodiversity and heritage, thus avoidance and mitigation should be emphasised, and the suggested compensation is likely to be unequal to the negative consequences of the projected habitat loss.	

14.3 Legislation, Planning Policy and Guidance

14.3.1 **Table 14-2** presents the legislation, policy and guidance relevant to the historic environment (terrestrial) assessment and details how their requirements have been addressed in this assessment.

Table 14-2: Relevant legislation, policy and guidance regarding historic environment (terrestrial)

Legislation/Policy/Guidance	Consideration within the Environmental Statement
Ancient Monuments and Archaeological Areas Act 1979 (as amended) (Ref 14-3)	
Imposes a requirement for Scheduled Monument Consent for any works of demolition, repair and alteration that might affect a Scheduled Monument.	There are no Scheduled Monuments in the study area, so none are capable of being affected by the Project.
Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 14-24)	
Sets out the principal statutory provisions that must be considered in the determination of any application affecting listed buildings and conservation areas. Section 66 and 72 are specifically applicable (see the Cultural Heritage DBA for further details, **Appendix 14.C [TR030008/APP/6.4]**).	Listed buildings and conservation areas in the study area have been identified. **Section 14.6** indicates that there is a single Grade II listed building located within the 2km study area. There are no conservation areas in the study area.
NPSfP (Ref 14-8)	
Section 5.12 of the NPSfP recognizes that the construction, operation and decommissioning of port infrastructure has the potential to result in adverse impacts on the historic environment. It sets out the expectations for assessment if a development site includes or has potential to include heritage assets with an archaeological interest.	The requirements of the NPSfP have been taken into account in the historic environment assessment for the Project.
National Planning Policy Framework ("NPPF") (Ref 14-21)	
The NPPF sets out the Government's planning policies for England and how these should be applied to contribute to the achievement of sustainable development. Section 16 specifically deals with the historic environment. The NPPF sets out a clear framework to ensure that heritage assets are conserved, and where appropriate enhanced, in a manner that is consistent with their significance. Significance is defined in Annex 2 of the NPPF.	The requirements of the NPPF have been taken into account in the historic environment assessment for the Project.

Legislation/Policy/Guidance	Consideration within the Environmental Statement
National Planning Practice Guidance ("PPG") (Ref 14-22)	
The PPG provides further advice and expands on the guidance and policy outlines in the NPPF. Paragraph 009 states that heritage assets may be affected by direct physical change or by change to their setting. Paragraph 013 recognises the contribution that setting makes to the significance of the heritage asset does not depend on there being public right or the ability to experience that setting. The PPG discusses how to assess if there is substantial harm and the importance of assessing if a proposal causes substantial harm that is the impact of significance of the heritage asset.	The guidance provided in the PPG has been taken into account in the historic environment assessment for the Project.
Infrastructure Planning (Decisions) Regulations 2010 (Ref 14-19)	
Section 3 refers to listed buildings, conservation areas and scheduled monuments. 3(1) When deciding an application which affects a listed building, or its setting, the decision-maker must have regard to the desirability of preserving the listed building or its setting or any features of special architectural or historic interest which it possesses. 3(2) When deciding an application relating to a conservation area, the decision-maker must have regard to the desirability of preserving or enhancing the character or appearance of that area. 3(3) When deciding an application for development consent which affects or is likely to affect a scheduled monument or its setting, the decision-maker must have regard to the desirability of preserving the scheduled monument or its setting.	The assessment has provided evidence to support consultees' consideration of listed buildings, conservation areas and scheduled monuments.
East Inshore and East Offshore Marine Plans (Ref 14-10)	
The East Inshore and East Offshore Marine Plans provide guidance for sustainable development for the coastal area between Flamborough Head to Felixstowe. They provide a clear approach to managing the East Inshore and Offshore areas, its resources and activities and interactions that occur in this area. Plan policy SOC2 is specific to heritage assets and	The requirements of the East Inshore and East Offshore Marine Plans have been taken into account by the historic environment assessment for the Project.

Legislation/Policy/Guidance	Consideration within the Environmental Statement
applies to both the Inshore and Offshore Marine Plans.	
North East Lincolnshire Local Plan 2013 to 2032 (2018) (Ref 14-23)	
Policy 39 Conserving and enhancing the historic environment sets out a clear approach providing guidance to developers on how to safeguard and respond to the historic environment, recognizing designated and non-designated heritage assets. The Plan's Strategic Objectives provide a framework for the Plan policies to facilitate the form and pattern of development to ensure that the vision is fully realized by 2023. SO6 refers to the built, historic and natural environment, to ensure that the development needs are met in a way that safeguards and enhances the quality of the built, historic and natural environment.	The requirements of the North East Lincolnshire Local Plan policies have been taken into account by the historic environment assessment for the Project.
Historic England Guidance (Ref 14-12, Ref 14-13, Ref 14-15, Ref 14-16 and Ref 14-17)	
The most relevant Historic England guidance for this report are the following: GPA1 provides advice for local authorities, planning offices and other consultants and stakeholders on the correct implementation of the historic environment policies detailed in the NPPF and PPG (Ref 14-12) GPA2 emphasizes the importance of having a knowledge and understanding of the significance of heritage assets likely to be affected by development (Ref 14-13). GPA3 provides guidance on the setting of heritage assets (Ref 14-15). Historic England Advice Note 12 outlines a recommended approach to assessing the significance of heritage assets in line with requirements of the NPPF (Ref 14-16). Historic England Advice Note 15 covers commercial and renewable energy development and the historic environment (Ref 14-17).	The historic environment assessment methodology takes into account Historic England guidance.
Principles of Cultural Heritage Impact Assessment in the UK (Ref 14-18)	
Provides guidance on understanding cultural heritage assets and evaluating the consequences of change.	The historic environment assessment methodology takes into account Institute of Environmental Management and Assessment ("IEMA") guidance.

Legislation/Policy/Guidance	Consideration within the Environmental Statement
Chartered Institute for Archaeologists ("ClfA") Code of Conduct and Standards and Guidance for Historic Environment Desk-Based Assessment. (Ref 14-6 and Ref 14-7)	
Provides a code of conduct and standards and guidance for historic environment desk-based assessment for archaeologists in order to appropriately investigate the historic environment and the impacts of proposed developments.	These codes, standards and guidance have been taken into account by the historic environment assessment.
Lincolnshire County Council Archaeology Handbook (2019) (Ref 14-20)	
Archaeology handbook that sets out guidelines for planners, developers, consultants and archaeological contractors. It contains principles of modern historic environment resource management that historic environment professional practitioners need to consider when working in Lincolnshire.	The historic environment assessment methodology takes into account the Lincolnshire County Council Archaeology Handbook guidance. The requirements of these policies have been considered when undertaking the assessment at this stage of the Project.

14.4 Assessment Methodology

Sources of Information

14.4.1 The basis of the cultural heritage baseline presented in this chapter is the information collected and presented in the DBA (**Appendix 14.C [TR030008/APP/6.4]**). This was developed through consultation of the following information sources:

a. HER data from –
   i. NELC
   ii. Lincolnshire County Council ("LCC")

b. The North East Lincolnshire Historic Landscape Characterisation ("NLHLC") data, 2014.

c. Lincolnshire Historic Landscape Characterisation data, 2017.

d. Historic England's National Heritage List for England ("NHLE") – data including listed buildings, world heritage sites, scheduled monuments, registered battlefields and registered parks and gardens.

e. Databases of known archaeological sites, find spots, historic buildings and previous archaeological works, including Archaeology Data Service.

f. Aerial photographs obtained from the HER and through Google Earth.

g. Lincolnshire Council's online land, planning and development website and the planning and advice documents contained within.

h. NELC's online land, planning and development website and the planning and advice documents contained within.

i. Historic Ordnance Survey and pre-Ordnance Survey mapping from online archives and the National Library of Scotland ("NLS") for historic maps.

j. Various documentary and internet sources, including British History Online.

k. Consultation with the Heritage Officer for NELC.

l. Local authority conservation area appraisal and management documents and their mapping.

m. National Record of the Historic Environment ("NRHE") held by Historic England.

n. Heritage Gateway for former National Monuments Record and excavation index data.

o. Vertical aerial photography and LiDAR imagery of the study area available from the National Collection of Aerial Photographs.

p. British Geological Survey ("BGS") Geology of Britain Viewer.

q. Soilscapes online for geological information.

r. LiDAR data viewed online via The Environment Agency online database.

s. Relevant records available from the Portable Antiquities Scheme.

t. The results of a geophysical survey undertaken in 2013 (ECUS Ltd, 2013) within the west part of the Project.

u. A site inspection visit was undertaken on 18 May 2022 to record the survival, extent, condition, setting and significance of cultural heritage assets within the 2km defined study area. The setting of heritage assets was also identified and potential Project impacts considered. Such works were undertaken as part of the Historic Environment DBA and the results incorporated into that document.

14.4.2 This chapter additionally incorporates information from the following sources:

a. The results of geophysical survey investigations, monitoring of geotechnical work, geo-archaeological borehole evaluation and trial trench evaluation carried out within the Site Boundary of the Project during November 2022 – February 2023 (**Appendices 14.F – H [TR030008/APP/6.4]**); and

b. Comments on the Scoping Report and PEI Report provided by the local planning authority (including the Heritage Officer for NELC), Historic England and other stakeholders provided in August 2022 (Scoping Report) and February 2023 (PEI Report), refer to **Table 14-1**.

Impact Assessment Methodology

14.4.3 This section sets out the approach to the assessment of the potential impacts and effects of the Project on designated and non-designated heritage assets. It is in line with the wider methodology set out in **Chapter 5: EIA Process [TR030008/APP/6.2]**. The objective of this assessment is to identify the potential for likely significant effects associated with the Project (which can be beneficial or adverse). The significance of potential effects has been determined by

considering the value of the cultural heritage resource with the predicted magnitude of impact upon it due to the Project.

14.4.4 The cultural heritage assessment includes an assessment of the heritage significance of potentially affected assets, in line with NPSfP (Ref 14-8). This requires the provision of information sufficient to enable adequate understanding of the potential impacts on the significance of any heritage asset. This is consistent with the requirements of NPSfP (Ref 14-8) and in line with the NPPF (Ref 14-21). Both documents also require this assessment to take account of changes to both the physical asset and its setting.

14.4.5 The NPSfP and the NPPF set out criteria which should be considered when assessing the significance of cultural heritage assets, which includes the archaeological, architectural, artistic and historic interest of the assets. These criteria have been used in the assessment of significance for each potentially affected asset and this information, in conjunction with professional judgement, has been used to assess the value of heritage assets.

14.4.6 Both documents relate to impacts affecting the value of heritage assets with negative, or adverse, impacts being equated to 'harm'. There is a requirement for the decision maker to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. NPSfP and NPPF make it clear that substantial harm to, or loss of, a Grade II designated asset should be exceptional and that to a Grade II* or I asset, or Scheduled Monument, should be 'wholly exceptional'. There is no direct correlation between the significance of effects identified through the EIA process and the level of harm caused to heritage significance.

14.4.7 The heritage baseline conditions relevant to this assessment are detailed in the Archaeology and Cultural Heritage DBA which is presented at **Appendix 14.C [TR030008/APP/6.4]**. The DBA was undertaken in accordance with guidance and regulations published by the Chartered Institute for Archaeologists (Ref 14-27), specifically the Standard and Guidance for Historic Environment Desk-Based Assessment and guidance and advice notes published by Historic England. This has been supplemented by a review of this baseline in light of subsequent changes to the Site Boundary.

14.4.8 Principles of Cultural Heritage Impact Assessment in the UK (Ref 14-18) is a guide to good practice in cultural heritage impact assessment published jointly by the IEMA, the Institute of Historic Building Conservation ("IHBC") and the CifA. The document provides guidance on understanding cultural heritage assets and evaluating the consequences of change and has been considered when undertaking the assessment.

Significance criteria

14.4.9 The value of a heritage asset (its heritage significance) is guided by its designated status but is derived also from its heritage interest which may be archaeological, architectural, artistic or historic (NPPF Annex 2, Glossary). Each identified heritage asset can be assigned a value in accordance with the criteria set out in **Table 14-3**, these criteria have been developed using available guidance, experience on comparable development schemes and professional

judgement. Using professional judgement and the results of consultation, heritage assets are also assessed on an individual basis taking into account any regional variations and individual qualities where applicable.

Table 14-3: Criteria for assessing the value of heritage assets

Asset Value	Description
High	World Heritage Sites Scheduled Monuments Grade I and II* listed buildings Registered battlefields Grade I and II* registered parks and gardens Conservation areas of demonstrable high value Non-designated heritage assets (archaeological sites, historic buildings, monuments, parks, gardens, or landscapes) that can be shown to have demonstrable national or international importance. Well preserved historic landscape character areas, exhibiting considerable coherence, time-depth, or other critical factor(s).
Medium	Grade II listed buildings Grade II registered parks and gardens Conservation areas Non-designated heritage assets (archaeological sites, historic buildings, monuments, parks, gardens, or landscapes) that can be shown to have demonstrable regional importance. Averagely preserved historic landscape character areas, exhibiting reasonable coherence, time-depth, or other critical factor(s). Historic townscapes with historic integrity in that the assets that constitute their make-up are clearly legible.
Low	Locally listed buildings Non-designated heritage assets (archaeological sites, historic buildings, monuments, parks, gardens, or landscapes) that can be shown to have demonstrable local importance. Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade. Historic landscape character areas whose value is limited by poor preservation and/ or poor survival of contextual associations.
Very Low	Assets identified on national or regional databases, but which have no archaeological, architectural, artistic or historic value. Assets whose values are compromised by poor preservation or survival of contextual associations to justify inclusion into a higher grade. Landscapes with no or little historical merit.

14.4.10 Having identified the value of the heritage asset, the next stage in the assessment is to identify the level and degree of impact to an asset arising from the Project. The impacts of a development upon heritage assets can be positive or negative; direct or indirect; long term or temporary; and cumulative. Impacts may arise during construction, operation and decommissioning. Impacts can occur to the physical fabric of the asset or affect its setting. Direct physical impacts are considered permanent and could result in the total, or partial, loss of a heritage asset. These impacts are not reversible. Impacts as a result of changes to setting are split between those resulting from construction activities which are short-term, and those considered to last for the duration of the development operation. These operational impacts are considered to be long-term, but can be reversed upon development decommissioning.

14.4.11 The level and degree of impact (impact rating) has been assigned with reference to a four-point scale as set out in **Table 14-4** which have been developed using available guidance, past experience on comparable development schemes and professional judgement. The assessment of the level and degree of impact has been made taking into account any defined mitigation measures, including those embedded in the scheme design. If no impact is identified, no impact rating has been given, and no resulting effect reported.

Table 14-4: Factors influencing the assessment of magnitude of impacts

Magnitude of Impact	Description of Impact
High	Changes such that the significance of the asset is totally altered or destroyed. For example, the permanent and complete removal of a heritage asset and total loss of heritage value. Comprehensive change to, or total loss of, elements of setting that would result in change to the significance of the asset and our ability to understand and appreciate its significance.
Medium	Change such that the significance of the asset is affected, for example, a significant proportion of a heritage asset is removed permanently, resulting in a loss of heritage value which affects the ability to understand the asset's character and function. Noticeably different change to setting affecting significance, resulting in erosion in our ability to understand and appreciate the asset.
Low	Change such that the significance of the asset is slightly affected. For example, a small proportion of a heritage asset is removed permanently resulting in a small loss of heritage value; however, this does not affect the ability to understand and/or characterise the resource. Slight change to setting affecting significance resulting in a change in our ability to understand and appreciate the asset.
Very Low	Changes to the asset that hardly affect significance. For example, a very small proportion of a heritage asset is damaged or removed permanently resulting in a very small loss of heritage value; however, this does not affect the ability to understand and/ or characterise the resource.

Magnitude of Impact	Description of Impact
	Minimal change to the setting of an asset that have little effect on significance resulting in no real change in our ability to understand and appreciate the asset.

14.4.12 Effects have been classified (taking into consideration any embedded / designed mitigation) using the matrix at **Table 14-5**, which takes account of the value of the heritage asset (**Table 14-3**) and the predicted magnitude of impact due to the Project (**Table 14-4**). Effects can be neutral, adverse or beneficial. Neutral effects, by their nature do not have a magnitude of impact.

Table 14-5: Classification of effects

Asset Value	Magnitude of Impact			
	Very Low	Low	Medium	High
High	Minor (not significant)	Moderate (significant)	Major (significant)	Major (significant)
Medium	Minor (not significant)	Minor (not significant)	Moderate (significant)	Major (significant)
Low	Negligible (not significant)	Minor (not significant)	Minor (not significant)	Moderate (significant)
Very Low	Negligible (not significant)	Negligible (not significant)	Minor (not significant)	Minor (not significant)

14.4.13 If appropriate, additional mitigation may be proposed where significant effects have been identified. An assessment of the significance of effect following the implementation of additional mitigation allows the residual effect to be recorded. Mitigation does not automatically reduce an effect but may be used to offset or compensate for an adverse effect.

Cumulative Effects

14.4.14 The cumulative effects of the Project in conjunction with other proposed developments in the vicinity of the Project have been assessed. This has been done qualitatively through consideration of any proposed developments with planning consent secured or those identified that could have an impact on archaeology and cultural heritage, including impacts from changes to an asset's setting.

14.4.15 The cumulative assessment has considered the presence of the Project in combination with the cumulative schemes (consented and application schemes) where there is a potential for significant cumulative cultural heritage effects. This part of the assessment is reported in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

Limitations and Assumptions

14.4.16 The information presented in this ES reflects that obtained and evaluated at the time of reporting and is based on the design for the Project and the maximum extents of land required for its construction and operation, based on the application of the Rochdale Envelope.

14.4.17 The baseline presented in this document is based upon the Cultural Heritage DBA (**Appendix 14.C [TR030008/APP/6.4]).** This work was assumed to be a correct starting point for assessment of the baseline in this document but was not based on the latest Site boundary. This document updates the baseline and assessment information to reflect subsequent changes in the Site Boundary of the Project and the results of the archaeological evaluations.

14.4.18 A wide range of data sources (see **Paragraph 14.4.1**) have been used to define baseline historic environment conditions in the study area. It is assumed that any data provided by third parties is accurate.

14.4.19 Those undertaking the archaeological evaluation fieldworks did not encounter any issues which limited their ability to undertake the works as programmed or to yield results capable of addressing the planned aims and objectives of the works.

14.4.20 The assessment of potential impacts and effects has assumed that all individual finds (findspots) recorded on the HER within the study area were removed when found and are therefore no longer present in situ. The location of find spots has been considered when assessing the significance of archaeological sites in their vicinity.

14.4.21 Unless otherwise stated, it has been assumed that 100% of the area within the Site would be physically affected by the proposed works and the impact on applicable heritage assets listed below have been assessed accordingly. Any refinement to the Project design may reduce the currently defined impacts.

14.5 Study Area

14.5.1 The study areas for the historic environment (terrestrial) assessment were defined to include heritage assets that have the potential to be at risk from possible direct and indirect impacts that might arise from the construction, operation and decommissioning of the landside infrastructure elements of the Project.

14.5.2 The proposed Site Boundary presented and assessed in this ES differs to that presented in the PEI Report, which differs from those presented in both the DBA (**Appendix 14.C [TR030008/APP/6.4]**), and the WSI (**Appendix 14.E [TR030008/APP/6.4]**). These alterations have come about as the design of the Project has evolved to take account of the needs of the Project, its impact upon the landscape and various design requirements and constraints. The baseline presented in this chapter, and the assessment which follows, are based upon the current Site Boundary of the Project.

14.5.3 A study area of 1.6km from the approximate centre of the Site was defined to capture all cultural heritage assets with the potential to be affected by the Project. For designated heritage assets, the study area was extended to 2km to capture heritage assets whose significance may be impacted by the Project through changes to their setting (refer to **Figure 14.1** for designated heritage assets and **Figure 14.2** for non-designated heritage assets **[TR030008/APP/6.3]**). However, neither of these boundaries were treated as inflexible and where high value (designated or non-designated) assets were present beyond these boundaries they were also considered as part of this work. Which assets were considered beyond the limits of the study areas, was determined by professional judgement, taking into account such things as the value/sensitivity of the asset and the likelihood of significant impact.

14.5.4 The study areas have been established based upon the current environment of the Site and theoretical views across it, taking account of the maximum heights of the Project as set out in the parameters section of **Chapter 2: The Project [TR030008/APP/6.2],** and therefore the visibility of it. The Project sits within a highly industrialised environment, elements of which act as visual screening barriers to the Project. The majority of these screening elements (Immingham town and Immingham Dock) sit to the north-west of the Project, with the Humber to the north and north-east, whilst the area to the south and south-east of the Project is generally more open. For this reason it was decided to skew the centre of the study area slightly in order to capture more assets in the open area to the south / south-west of the Site – where effects on setting are more likely, whilst reducing the number of assets captured which sit within or to the west of Immingham town and Immingham Dock, whose settings are incapable of being significantly affected by the Project due to the screening effect of the town and the Dock.

14.5.5 The extents of both the 1.6km and 2km study areas lie within the Humber Estuary to the north-east and east of the Site, and so in this direction all terrestrial assets capable of having their setting potentially affected by the Project have been assessed.

14.5.6 To the north and north-west, the study areas include parts of the Immingham Dock and its associated infrastructure and parts of the modern town of Immingham itself. Thus, assets up to and within these locations are included in the study areas. Assets beyond the Dock and the town are not within the study areas, but these are deemed to be sufficiently screened from any significant impact to setting by the structures of the Dock and the town.

14.5.7 To the south, south-west and south-east the land is more open. However, a number of large industrial developments on the periphery of the study areas provide screening to assets beyond the study areas, as does the A180 which acts as a significant ‘break’ in flow of the landscape.

14.5.8 For these reasons, the assessed study areas include all heritage assets whose settings are capable of being significantly impacted by the Project.

14.5.9 More information on visibility to the Project from the surrounding landscape is presented in **Chapter 13: Landscape and Visual [TR030008/APP/6.2]**.

14.6 Baseline Conditions

14.6.1 This section describes the baseline environmental characteristics for the Site and defined study areas with specific reference to cultural heritage. The heritage assets discussed within this section, including designated and non-designated heritage assets, are identified by their unique identification number assigned by the NHLE for designated assets and by the HER for non-designated heritage assets. The HER numbers are prefixed MNL for North East Lincolnshire. All assets are identified within the text using their unique identifier and can be cross-referenced to the Gazetteers (**Appendix 14.A** and **14.B [TR030008/APP/6.4]**) and **Figures 14.1** and **14.2 [TR030008/APP/6.3]**.

Geology and Soils

14.6.2 The BGS web-based Geology of Britain Viewer (Ref 14-4) indicates that the local geology within the Site is characterised by superficial deposits of river and estuarine Alluvium (clay, silt and sand) that formed up to 2 million years ago in the Quaternary Period and tidal flat deposits (clay and silt). The underlying bedrock is Sedimentary Chalk Bedrock. The alluvium formed in an environment dominated by rivers with fine silt and clay deposited from overbank floods and some bogs depositing peat. The Soil Survey of England and Wales soil association mapping, 1:250,000 scale, (Ref 14-26) describes the soils as loamy and clayey soils of coastal flats with naturally high groundwater, characteristic of wet brackish coastal flood meadows. Historic boreholes from the BGS viewer that were drilled in 1937/1938 along the southern side of the West Site indicate topsoil and clay to a depth of over five feet and sealing a peat (four feet thick) over a sequence of silt, boulder clay and chalk (borehole references TA21SW91, TA21SW278).

14.6.3 The Humber Estuary is one of the largest river estuaries in Britain and high flood banks contain the estuary as it opens out as it enters the North Sea. On the south bank there are ports and extensive industrial complexes of oil and chemical tanks, towers, chimneys, warehouses and storage areas, with some agricultural land. Long views across the landscape are a dominant focus within much of the area. Along the Humber Estuary the landscape is always changing due to the tidal movements, which expose extensive mudflats at low tide, and the effects of the changing weather. Large ships, including ferries, container ships and cargo ships, are constantly moving in and out of the estuary.

14.6.4 The farmed landscape has been altered by relatively recent industrial and commercial development but originally was more open and expansive with large regular fields and few visible field boundaries. Along the estuary much of the land has been formed from reclaimed saltmarshes of the estuary using the drainage of the wet alluvial soils, and from a process known as ‘warping’ (seasonal tidal impoundment of farmland with water rich in silt). This has created a fertile land that is drained by a network of ditches which supports arable farming with areas of saltmarsh and reedbeds along tidal channels that cross the drained marshes. Immingham Dock with its port, warehouses, storage and production areas, chimneys and lighting columns is a major and distinctive feature of this part of the estuary. Mudflats are exposed along the estuary at low water.

14.6.5 Recent geoarchaeological works have allowed a detailed deposit model to be prepared for the Site, which is detailed in **Paragraph 14.6.52**.

Site Conditions

14.6.6 The Site is situated to the east of the Port of Immingham ("the Port") and largely outside of the operational area of the Port. The Port comprises several operational areas, with bulk commodities such as liquid fuels, solid fuels, and ores, as well as freight, being handled from in-river jetties. The area surrounding the Port is industrial in nature, being dominated by chemical manufacturing, oil processing and power generation facilities. Residential and commercial properties are present to the south of the Port on Queens Road (A1173) and lie within, and adjacent to, the Site Boundary. Beyond the industrial facilities, the wider area is largely agricultural. The nearest residential area is the town of Immingham approximately 1km from the western edge of the West Site. The Site is generally flat and is situated below the 2m contour.

14.6.7 The Project components of the landscape infrastructure (associated development) are set out in **Section 2.4 of Chapter 2: The Project [TR030008/APP/6.2]**.

Historic Landscape Characterisation

14.6.8 The NLHLC data from 2014 (**Figure 14.3a**) identifies the West Site and Temporary Construction Areas as areas of **Modern Fields**, although part of the rectilinear field pattern that is recorded on the 1837 tithe map and historic OS maps is still visible (**Private Planned Enclosure**). The East Site and Bridleway Along the Western edge of the Temporary Construction Area are identified as part of a larger chemical works at Immingham Dock (**Other Industrial**) and has not retained any time depth linked to the character of the historic landscape. The Pipeline Corridor is identified as a mixture of recently developed warehouses, distribution, industrial works and former abandoned works areas which also has no time depth to its historic character (**Other Industrial** and **Warehouses and Distribution**) which overlies areas of former private planned enclosure and modern fields. A narrow belt of **Plantation Woodland** known as 'Long Strip' is also present in this area (and encompasses the site of the proposed Jetty Access Road and Piperack Corridor). This plantation is shown on historic Ordnance Survey ("OS") maps dating to the second half of the 19th century and partially survives either side of Laporte Road. The Kings Road area is a mix of **Modern Fields**, **Recreation Ground**, **Terraced housing** and **Other industrial works** and chiefly relates to the 20th century development of the Dock and associated industries.

14.6.9 In addition to the above data, the region of and around the Project was also part of the Lincolnshire Historic Landscape Characterisation Project, which commenced in 2008 and completed in September 2011. It used Geographic Information System ("GIS") mapping to categorise and characterise the landscape of the county over time. The process involved the definition of landscape types which were used to categorise all portions of the landscape. These were then grouped into 'character zones' of coherent landscape blocks

which were, in turn, grouped into larger 'character areas', the largest landscape components of the study.

14.6.10 The Site (**Figure 14.3b**), as well as the area surrounding it, falls into **NOM2: The Northern Marshes (Immingham Coastal Marshes).** This is broadly defined as a zone dominated by industrial activity (comprising 36% of the character zone) and which, prior to enclosure in the 18th century, was mainly comprised of saltmarsh grazing land. The zone is largely modern in character although historic elements can still be identified in the landscape.

Designated Heritage Assets

14.6.11 There are no World Heritage Sites, Scheduled Monuments, Grade I or II* listed buildings, conservation areas, registered parks and gardens or registered battlefields within the 2km study area for designated heritage assets.

14.6.12 Within the 2km study area there is a single Grade II listed building, comprising of the Immingham War Memorial (NHLE 1455139). Unveiled in 1925 the memorial was originally dedicated to the fallen of WWI. Subsequently, the names of local people who lost lives in WWII were added, with the name of a local man who fell in the Afghan war added in 2010. The asset is located at the junction of Humberville Road and Pelham Road, approximately 1.57km to the north-west of the Site, within Immingham, on the eastern edge of the town.

14.6.13 Beyond the 2km study area, there are a number of designated assets (listed buildings), which are considered below due to the significance of the asset and the potential for their setting to be impact by intervisibility to the Project.

14.6.14 Churchfield Manor (NHLE 1161630) is a Grade II listed 17th - 18th centuries vernacular farmhouse located 2.7km to the north-west of the centre of the Site off Church Lane on the northern edge of Immingham, bordered to the north by agricultural fields, to the east by Immingham Golf Course and by Immingham to the south.

14.6.15 The Grade I listed Church of St Andrew (NHLE 1310011) dates to the 11th – 12th centuries with additions and alterations made to it throughout the 13th – 17th and 20th centuries, significant as an early medieval parish Church.

14.6.16 The Iron Bungalow (NHLE 1391349) is a Grade II Listed Building located at 359 Pelham Road, approximately 2.7km west of the centre of the Site, within Immingham itself (just to the south-west of the centre of the town). The asset is a corrugated iron bungalow dating to 1907 constructed by Price, Wills and Reeve, the contractors employed to build Immingham Dock. It is an example of rapidly constructed temporary housing – designed for employees involved in building the Dock, and is possibly a surviving element of "Tin Town" (**Paragraph 14.6.40**).

14.6.17 The Church of St Peter and St Paul (NHLE 1346978) is a Grade II* listed building dated to 1779-1781 (restored in the 20th century), which replaced an earlier church on the site, whose nave and tower collapsed in 1746. Within the churchyard are the remains of a free standing, Grade II listed, stone cross (NHLE 1020023, also recorded as NHLE 1161697) dated to 1725. The church and its churchyard (which includes the cross) are located on the north-west edge of the village of Stallingborough *c.*3.3km to the south-west of the centre of the Site.

14.6.18 Stallingborough scheduled medieval settlement (NHLE 1020423) is located in the north-east of the village of Stallingborough c. 3.3km to the south-west of the centre of the Site. The monument includes earthwork and associated buried remains of part of the settlement of Stallingborough, together with the earthworks of a post-medieval manor house and associated formal gardens. These all lie to the west of the modern settlement, extending around and to the south of the 18th century church of St Peter and St Paul. At the time of the Domesday survey in 1086, Stallingborough, with a recorded population of 47, was the third largest settlement in northern Lincolnshire, only smaller than Barton and Grimsby. Henry III (1216-72) granted the right to hold a weekly market and annual fair to the manor that was confirmed to Sir William Ayscough by Henry VIII in 1529. Surviving tax records in the early 14th century imply a population of 50-60 households, but it is thought that this was severely reduced in the middle of the century by the Black Death and other factors, because Stallingborough was granted 70% tax relief in 1352. Records indicate that there must have been at least 10 households by 1428, but the settlement was still receiving around 20% tax relief in 1448 and 1463. By 1563, possibly as a result of the re-establishment of the regular market and fair, the settlement had expanded to 150 households. In the 17th century there is some evidence of depopulation, but it appears to have been mainly in the 18th century that the settlement rapidly contracted once more, this time through the action of the Boucherett family enclosing land and reducing the number of tenants. In the 1720s there were around 120 families in the parish, but following the enclosure of the medieval open fields in 1736-37, this had dropped to 67 households by 1758. The settlement is believed to have steadily contracted still further, starting to rise again towards the end of the century. By the time of the first national census in 1801, Stallingborough had a population of 274 people in 59 houses.

14.6.19 The monument was surveyed by the Royal Commission on the Historical Monuments of England in 1978 which identified two main groups of earthworks. The first is an extensive area of village earthworks, standing up to 1m high, representing streets, building platforms and closes laid out in the medieval period and at least in part occupied up to the early 18th century. The second area lies around the northern side of the churchyard and represents the remains of a post-medieval manor house and the earthworks of the associated formal gardens. In addition, the survey sketch plotted further village earthworks to the west using aerial photographs taken before the area was levelled in the spring of 1978. Also noted were the crop marks of formal garden features to the north of the railway line.

14.6.20 The medieval village of Stallingborough was originally located on the edge of the saltmarsh that has since been almost totally reclaimed. A low hill formed an early settlement focus and this elevated position was used for the church and the principal manor house of the village. To the south of this was a main street running east-west, forming a routeway connecting the other saltmarsh side villages. Part of this street remains in use as Pinfold Lane and is continued across the southern part of the monument as a hollow way. All of these hollow ways are flanked by the remains of medieval and post-medieval properties defined by banks and/or ditches with raised platforms marking the sites of

buildings. All of these earthworks are at most 1m high, typically lower. The survey identified four platforms where the remains of brick buildings could be identified.

Non-Designated Heritage Assets

14.6.21 NELC maintains local lists of historic assets of special interest. The local list for 'Immingham and the Villages' includes two assets, a high-status Roman settlement and industrial site (MNL4490) (refer to section below on Roman assets) and the Immingham Police Station (MNL4726) located approximately 1.57km north-west of the centre of the Project (refer to section below on Roman assets).

Prehistoric (up to AD 43)

14.6.22 There are no assets of this date within the Site Boundary. There is one asset of prehistoric date recorded within the 1.6km study area. The earliest evidence is a pair of prehistoric ditches (MNL4182), identified approximately 1.1km south-east of the Site centre. These ditches may have been dug to flank a trackway. They contained flintwork of Neolithic (4,000BC-2,500BC) or Bronze Age (2,500BC-700BC) date. The flintwork suggests prehistoric occupation in the area.

Roman (AD 43 to AD 410)

14.6.23 There are no assets of this date within the Site Boundary. Archaeological investigation within the 1.6km study area has found evidence for a high-status Roman settlement and industrial site (MNL4490), located approximately 1.4km south-west of the Site at Mauxhall Farm at Stallingborough Interchange. An undated possible oval enclosure (MNL4618) to the west of the West Site could be related to the Roman settlement.

14.6.24 Undated cropmarks of rectangular ditched enclosures (MNL4607) located approximately 1.1km to the south-east of the Site centre, could form part of the Roman landscape.

Early Medieval (AD 410-1066)

14.6.25 There are no assets of early medieval date (AD 410-1066) within the Site Boundary or either study area.

Medieval (1066-1540)

14.6.26 Immingham is mentioned in Domesday, the Lindsey Survey (c.1115) and the Early Yorkshire Charters (1090-6) and historically within the wapentake and deanery of Yarborough (Ekwall, 1960; Cameron, 1991). The parish also contains the hamlet of Roxton. The form of the settlement appears to have been a chain of farmsteads or hamlets laid out along a pair of parallel roads, with a denser core around the parish church. Aerial photographs show some possible burgage plots to the south-west of the church, suggestive of at least some planning to the village. Roxton has no obvious topographic influence upon settlement form. The former earthworks of the hamlet have the appearance of a small, nucleated core around a moated manorial site, possibly with a tight grid like pattern of roads.

14.6.27 There are no assets of this date within the Site Boundary. There is some evidence for medieval (AD 1066-1540) settlement activity within the wider study area. A possible deserted medieval settlement (MNL326) near Mauxhall Farm is visible on aerial photography, including ridge and furrow cultivation features, trackways, and possible building platforms. Ridge and furrow (MNL2235) are also recorded at Stallingborough.

Post Medieval (1540-1900)

14.6.28 Local abbeys began to promote drainage schemes in the area from the 12th century. However, from the 17th century, coastal reclamation, drainage and enclosure had a significant impact on the rural landscape on the north side of the estuary. On the south side, flood defences were built to protect the developing towns and industrial areas. Warping (the process by which water was deliberately flooded over the land to enrich the soil with riverine sediments) was introduced by the Dutch in the 18th century. Later, Parliamentary enclosures produced the landscape of regular, geometric fields, mostly enclosed by dykes, with associated large brick-built isolated farmsteads and excavation of brick pits for the extraction of Pleistocene clays (for example at Barton). By 1870 the parish of Immingham had a population of only 237.

14.6.29 Within the Site Boundary of the Project there are five non-designated assets of this date. This includes a medieval plantation (MNL1797 – 'Long Strip') noted on the OS map of 1887-1889 which lies within the boundary of the East Site and the Pipe Rack and Jetty Access Road. MNL2085 is the site of a possible former sea defence bank which sits within the Pipeline Corridor. MNL4263 and MNL4426 are the sites of possible Beacons located near to the sea defence bank, within the Temporary Construction Area. Asset MNL3523 relates to the historic route of Kings Road, also seen on the OS maps of 1887 – 1889. The section of modern Kings Road from where it becomes Queens Road near Knauf (UK) Immingham up to the junction with Pelham Road, forms part of this historic route. Sections of this sit within the Site Boundary of the Kings Road Overhead Lines areas.

14.6.30 Within the wider study area there are a number of non-designated assets of this period. This includes another woodland feature (MNL1799 – Fox Covert) seen on historic OS maps and of low value. Other landscape features recorded include an osier at Reeds Meer (MNL2684), a mere at Stallingborough (MNL2685), and a spring also at Stallingborough (MNL4299).

14.6.31 Aerial photography has also recorded the remains of post-medieval field boundaries and narrow ridge and furrow cultivation features at Harborough Marsh (MNL4648, MNL4653, MNL4658, MNL4659, MNL4660), as well as the presence of either singular or a series of drainage ditches. These include North Moss Lane, Kiln Lane and Laporte Road, amongst others (MNL1793, MNL4603, MNL4604, MNL4606, MNL4620).

14.6.32 A series of historic roads and trackways (MNL3507, MNL3508, MNL3509, MNL3510, MNL3512, MNL3522, MNL3524) of post-medieval date are recorded on the early OS maps which may have origins in the medieval period.

Modern (1901-present)

14.6.33 Within the study area, the first half of the 20th Century was dominated by the construction of Immingham Dock, and its associated rail infrastructure, and fortifications associated with the World Wars, World War II (WWII) in particular. The second half of the 20th Century was associated with the continued use and expansion of the Dock and industry around it, bucking the general trend of much of the industrial north-east which saw widespread economic decline during this period.

14.6.34 The population of Immingham grew steadily but remained relatively small throughout much of this period, Immingham itself being eclipsed by the Port. However, the population expanded in the 1930s as new housing developments were created and with the development of new industries in the 1950s – 1960s. This meant that Immingham had a population of 11,506 by 1981.

14.6.35 Within the Site Boundary there are 10 non-designated assets of this date. This includes a number of WWII features; MNL4640 (an anti-landing obstacle within the West Site), MNL4643 (a possible WWII bomb crater in the Temporary Construction Area) MNL4651 (the possible site of a WWII barrage balloon mooring site within the East Site) and MNL4644 (the site of a possible military installation which partially extends into the boundary of the Bridleway Along the Western edge of the Temporary Construction Area).

14.6.36 Immingham Dock itself was built by the Humber Commercial Railway and Dock Company in association with the Great Central Railway and opened in 1912. The Dock was served by the Immingham Dock Branch – a large complex of railway lines and sidings which branched off the main line. Elements of this complex are still in operation today (as part of Network Rail) and elements of the line are still in use today and present within the Pipeline Corridor (MNL3039).

14.6.37 The Grimsby and Immingham Electric Light Railway (G&IER) was also opened in 1912 and connected Grimsby with Immingham Dock. This tramway was effectively a commuter line, transporting Dock workers from Grimsby to Immingham Dock and back. The route of this tramway runs around much of the area but sections of it pass through the boundary of the Pipeline Corridor (MNL3078 and MNL2087). The line closed in 1961 and whilst much of the track has now been removed, sections of it are still visible as marks on the ground. A tram shelter on Queens Road (within the Pipeline Corridor) associated with the line (dated to *c.* 1914, MNL4715), was dilapidated but extant until its demolition in 2021, to make way for a new border control post.

14.6.38 There are two rows of non-designated terraced properties on the Queens Road (ACM1) of some historic and architectural interest that have the potential to be impacted by the Project. These date to the early 20th Century (seen on the 1932 Ordnance Survey map) and are thought to relate to accommodation for Dock workers as Immingham Dock expanded and became busier. These properties lie within the Site (but not within the construction area) and so may have their setting impacted by the Project. In addition to the above, the northern extent of the Immingham H.C.C. landfill site (MNL1063) extends just into the southern edge of the West Site.

14.6.39 Within the wider study area, aerial photographs and historic OS maps record historic flood defences across the study area, including at Immingham, Kiln Lane Trading Estate, and at Harborough Marsh (MNL4682, MNL2086, MNL4608, MNL4650). Historic OS maps also record the presence of several features associated with coastal navigation and transportation, including Stallingborough Ferry (MNL3131) and the site of a coastguard station (MNL1790).

14.6.40 As noted, Immingham Dock was opened in 1912, with construction of the Dock starting in 1906. This Dock is recorded as MNL272. The development of the Dock went hand in hand with the construction of rail and other infrastructure to support its industrial development with an associated increase in population seen in the surrounding area. This includes a temporary settlement to house the Dock construction workers, which was established at Immingham and comprised a series of corrugated tin huts and other temporary buildings, known as “Tin Town” (MNL1077).

14.6.41 Other features associated with the historic development and operation of the Dock within the wider study area, include a coaling stage (MNL3097) and a former grain store (MNL4429). In addition, there are several records relating to the use and expansion of the transportation infrastructure associated with the Dock and Port. This includes: MNL2819, the site of the original Immingham East signal box (demolished 2010), MNL3040, the site of an engine shed opened in 1912, in use until 2015 and then demolished in 2019, and MNL4656, the site of a possible, disused, railway embankment.

14.6.42 A series of small rectilinear enclosure earthworks, of uncertain function are visible in aerial photographs dated to 1942, between the area of the Pipeline Corridor and East Site (MNL4652)

14.6.43 The Police Station (MNL4726, *c.*1.57km to the north-west of the Project, **Paragraph 14.6.21**) also dates to this period (1912). The Police Station, cells and houses were built to serve the developing town and are now currently used as private offices. The Police House is considered to have low heritage value associated with its historic and architectural interest as an early 20th century civic building.

14.6.44 During World War I (WWI) the Dock was a submarine base for British D-class submarines. It was later used for cruise ships in the 1930s, including vessels of the Orient Steam Navigation Company, White Star Line and Blue Star Line. Following the end of World War I (“WWI”) trade declined, as it did elsewhere along the east coast, including demand for shipping services and new ships.

14.6.45 However, World War II (“WWII”) revived the dock’s prospects, but, together with other ports along the east coast such as Hull, it became the target of bombing raids. It became a naval base and headquarters for the Royal Navy and anti-aircraft batteries were located around the Dock during the war. There remain numerous features relating to WWII activity recorded within the wider study area, including gun emplacements, anti-landing obstacles, barrage balloon sites and other buildings and installations (MNL1501, MNL1534, MNL4630, MNL4631, MNL4632, MNL4633, MNL4634, MNL4641, MNL4655, MNL4679, MNL4684, MNL4675, MNL4689, MNL4630, MNL4640, MNL4675). Evidence of German

bombing raids is also represented by two small circular hollows on aerial photographs (MNL4623, MNL4645).

14.6.46 In the second half of the 20th century the Dock expanded with the construction of east and west jetties and the addition of several deep-water jetties for bulk cargo. Within the wider study area, Immingham Oil Terminal jetty was constructed in 1969 on the banks of the Humber, east of the Dock entrance, whilst Immingham Bulk Terminal was commissioned in 1970 for the export of coal and the import of iron ore. In 1985 the Immingham Gas Jetty was opened.

Undated

14.6.47 Within the Site Boundary, MNL4674 is located just within the northern edge of the West Site. It is an undated curvilinear ditched enclosure visible as crop marks seen in aerial photographs taken in 1942.

14.6.48 Within the wider study areas, there are several assets of an unknown date located within the 1.6km study area, including several undated cropmark sites recorded on the HER. These include an area of enclosures or natural features (MNL4106), a sub-circular feature, possible prehistoric ring ditch or another natural feature (MNL4622), and linear features (MNL4400) to the south of Kiln Lane Industrial Site. These features are undated and could belong to any period between the prehistoric to post-medieval and modern period.

14.6.49 Geophysical survey undertaken within the West Site in 2013 did not positively identify any significant archaeological features. However, various anomalies were detected which may have related to buried paleoenvironmental features (former tidal channels and pools), as well as possible medieval salt production sites. Recent archaeological works (see below) would suggest that these are in fact not present at the West Site and the signals in fact relate to geological anomalies.

14.6.50 Recent former land boundaries, land drains, services and ground disturbance were also identified.

Deposit Model

14.6.51 Recent archaeological work undertaken at the Site has allowed the development of a detailed deposit model for the Site (see **Paragraph 14.6.64**). This model was constructed using geotechnical logs from previous works in the area as well as the works undertaken as part of this Project.

14.6.52 The deposit model developed by this work is presented in detail in **Appendix 14.G [TR030008/APP/6.4]**. In outline the deposition sequence across the Site is:

a. Modern soil profile/made ground (modern). Made ground is located predominately in the Pipeline Corridor and East Site and was up to 1.2m thick. The modern soil (seen across the rest of the Site) is a firm dark greyish brown clay silt, generally 0.6m thick.

b. Alluvium (Holocene) and Organic alluvium (Holocene). A firm to soft black/dark grey laminated silts with frequent organic material broadly distributed across the area of the Site. Found at depth of 0m – 4m. These deposits likely represent sediment accumulation in low energy environments, potentially including slow-moving or deactivated channels and within freshwater backswamp or more vegetated saltmarsh environments.

c. Minerogenic Alluvium (Holocene). Deposits of variously sandy or slightly gravelly silty clay were recorded as pockets widely across the Project at depths varying from 1m to 10m. This deposit represents sediment accumulating under the influence of rising post-glacial sea-levels, deposited within a range of settings from early Holocene channel systems through to mud flats and saltmarsh environments within the succeeding extensive intertidal floodplains of the Humber Estuary.

d. Peat (Holocene). Peat is present at depths of 3 – 5 m across the West Site and is generally less than 1 m thick. Peat is generally absent within the Pipeline Corridor and East Site. Peat is indicative of transitions to semi-terrestrial conditions on the floodplain supporting the growth of wetland vegetation such as that found growing in reed swamp, sedge fen or Fen Carr, likely as a response to a reduction in rates of relative sea level rise. The distribution of the peat deposits indicates that they were likely growing either in floodplain hollows or within a network of narrow dendritic channels, typical of those found in mudflats.

e. Glacial till (Late Pleistocene). This consists of deposits of variable composition, but generally comprising firm sandy silt, silty clays or clays with frequent gravel clasts, including small to large, subrounded and rounded, chalk and possible flint/quartz pebbles and stones. The deposit is typically over 10m thick and is present at a depth of 4m – 8m, overlying the bedrock. This material is likely to have been deposited by the advancing Late Devensian ice sheet that reached its maximum extent in this area during the Late Glacial Maximum (“LGM”) at c. 23,000 – 17,000 years ago.

f. Bedrock (Cretaceous). A white, silty chalk gravel deposit, transitioning into high density fractured yellowish white chalk with marls (the Burnham Formation). The surface of the bedrock is generally encountered at depths of 18m – 22m.

14.6.53 The deposit model did not find any conclusive evidence for the paleochannel suspected to be present at the site based on earlier geophysical survey work (Ref 14-5), see **Paragraph 14.6.67**.

Archaeological Investigations

14.6.54 Prior to the work undertaken in relation to this Project, the only archaeological investigation carried out within the Site Boundary was a geophysical survey undertaken within the bounds of what is now the West Site in 2013. This work (Ref 14-5) identified various anomalies which likely relate to buried paleoenvironmental features (former tidal channels, pools and saltmarsh). Some of the features identified were believed to possibly relate to medieval salt production sites (salterns) located on the edge or close to the former tidal

channels. Recent former land boundaries, land drains, services and ground disturbance were also identified near to the Project. A geophysical survey was undertaken in 2011 at land next to Queens Road to the east of the West Site (Ref 14-25). This survey recorded variations reflecting the presence of modern features including boundary fencing, a gas pipeline and miscellaneous ferrous rich objects.

14.6.55 Recent archaeological investigations associated with the Project (undertaken in 2023, **Appendices 14.F – H [TR030008/APP/6.4]**) have included monitoring of geotechnical investigations, geo-archaeological evaluation, geophysical survey and trial trench evaluation. The results of these are detailed below.

Archaeological Trial Trench Evaluation 2023

14.6.56 An archaeological trial trench evaluation was undertaken within the area of the West Site from January – February 2023. This work involved the excavation of 107 trial trenches (each measuring 30m long x 2m wide, excavated onto the archaeological horizon – typically a depth of *c.*0.30m) which equated to a *c.* 3% sample of the area of the West Site. Of these trenches four (Nos 1-4) were targeted on suspected archaeological features, including a possible paleochannel and possible salterns. The works were governed by a WSI (**Appendix 14.E [TR030008/APP/6.4]**) which had been approved by the Heritage Officer for NELC. A full report on the works is presented as **Appendix 14.F [TR030008/APP/6.4]**.

14.6.57 In summary, the trial trench evaluation did not uncover any significant archaeological features, finds or deposits. Of the 107 trenches excavated archaeological evidence was uncovered in three of them. A linear feature (ditch) was uncovered in trench 3, the stratigraphy of this feature demonstrated that it was likely modern in origin and had a drainage function. A further linear feature (ditch) was also noted to run across trenches 41 and 67. Ceramic material recovered from the fill was derived from a modern land drain, indicating that this ditch was also modern in date and had a drainage function.

14.6.58 No evidence for the salterns and paleochannel were found within trenches 1-4 (or any other trial trenches).

Archaeological Geophysical Survey 2023

14.6.59 A detailed gradiometer survey was undertaken across the site of the Temporary Construction Area in January 2023. The work was governed by a WSI (**Appendix 14.E [TR030008/APP/6.4]**) which had been approved by the Heritage Officer for NELC. A full report on this work is presented as **Appendix 14.H [TR030008/APP/6.4]**.

14.6.60 The survey identified several possible archaeological anomalies (**Appendix 14.H, fig 3 [TR030008/APP/6.4]**). These includes several long, large linear features and one large rectangular feature. Given the known history of the area, it is possible that these relate to WWII defensive features. However, other origins such as being derived from much earlier activity (e.g. Roman or Medieval), or more modern activity (drainage / agricultural features), cannot be ruled out.

14.6.61 Two small curvilinear ditch features were identified to the west of the Temporary Construction Area. These features may also, potentially, be archaeological in nature. However, the weak nature of the signal also means that a natural origin (variation in geology) for the anomalies cannot be ruled out.

14.6.62 Two large, ferrous, responses were also identified. These may relate to modern activity, or possibly a bomb crater recorded in the area by the HER.

14.6.63 Numerous linear trends were noted across the north of the Temporary Construction Area, which may relate to past drainage or agricultural activity. To the south of the Temporary Construction Area, strong geological responses appear to reflect the intertidal environmental and alluvial processes which have taken place across the Site.

Geoarchaeological Evaluations 2023

14.6.64 A programme of geoarchaeological works, consisting of the archaeological monitoring of 40 geotechnical boreholes and the excavation of 14 geoarchaeological boreholes (across three transects) was undertaken in February – March 2023. The archaeological monitoring work spanned the West Site, the Pipeline Corridor and the East Site. The geoarchaeological work was focused on the West Site but also encompassed the Pipeline Corridor. The work was designed to provide information on the geoarchaeological and archaeological resource likely to be impacted by the Project and facilitate an informed decision with regard to any further archaeological and geoarchaeological work that may be required. In addition, borehole transects in the West Site targeted a possible paleochannel feature identified in a previous geophysical survey (Ref 14-5).

14.6.65 The works were governed by a WSI (**Appendix 14.E [TR030008/APP/6.4]**) which had been approved by the Heritage Officer for NELC. A full report on the works is presented as **Appendix 14.G [TR030008/APP/6.4]**.

14.6.66 This work has allowed the deposit model presented at **Paragraph 14.6.52** above to be developed.

14.6.67 The work did not reveal any archaeological features or finds, including in relation to the possible paleochannel feature referred to at **Paragraph 14.6.54** above. There was no clear evidence in the surface of the till for an early Holocene paleochannel cut into these deposits or for a distinct alluvial sequence infilling a paleochannel. The distribution and extent of peat and organic alluvium within the Holocene alluvial sequence was noted to be relatively evenly distributed across the area, rather than being focussed within this possible paleochannel feature.

14.6.68 However, the absence of evidence for an early Holocene channel here does not discount the possibility of a later channel cutting through the alluvial sequence, perhaps related to a dendritic channel typical of tidal mudflats, or a tributary channel draining east towards the Humber. The absence of peat and organic alluvium within the alluvial sequence in boreholes W-BH24 and W-BH28 (**Figure 3, Appendix 14.G [TR030008/APP/6.4]**) provides tentative evidence for subsequent fluvial erosion of such deposits. However, such channels are typically hard to identify in the sedimentary data available in borehole logs.

14.6.69 Peat deposits were noted at a depth of 3m – 5m across the West Site. These deposits contained a range of botanical remains (e.g. pollen and plant macrofossils) preserved in the waterlogged anoxic (oxygen-free) conditions, representing important archives of information on past climate and paleoenvironmental change and the impact of human communities on the landscape.

14.6.70 Organic-rich alluvium was recorded more widely across the Site, generally present at a depth of 0m – 4m. The geoarchaeological potential of organic-rich alluvium is similar to that of peat deposits, though in selected sequences the organic component is largely detrital and so deemed to be of limited geoarchaeological potential.

Offshore (Marine) Geoarchaeological and Geotechnical Evaluations 2023

14.6.71 A programme of geoarchaeological and geotechnical works was undertaken by Fugro in 2023 and geoarchaeologically assessed by Wessex Archaeology in order to identify, characterise and record potential geoarchaeological/ paleoenvironmental assets offshore – the detail of this work and its findings is presented in Chapter 15 (**Appendix 15.A Marine Archaeology Technical Report [TR030008/APP/6.4]**). The results of this work are summarised here in order to synthesise the heritage potential of the Site as a whole – both its onshore and offshore components, as a number of the aims and findings of the offshore work link to the aims and findings of the onshore work.

14.6.72 One of the aims of the marine work was to locate and characterise ancient rivers (paleochannels) which once fed into the Humber. This links directly to a similar aim of the onshore geoarchaeological work. The marine work sought to locate the point where the paleochannel linked with the Humber. The onshore work was not successful in locating the suspected paleochannel, finding no clear evidence for it. The marine works had slightly more success. Whilst not highly visible, certain deposits identified by the marine work do hint at the presence of a paleochannel (**see Appendix 15.A - features 7502 and 7500 [TR030008/APP/6.4]**). At this stage it is not clear if the possible channel identified by the marine work aligns with the suspected (but unidentified) onshore channel.

14.6.73 The marine work also sought to identify the presence of organic rich deposits – such as peat, another aim which aligned with the aims of the onshore geoarchaeological work. The results of the marine work are comparable to those of the onshore works in that it successfully identified shallow, outcropping peat deposits scattered throughout the area of survey (**see Appendix 15.A - features 7501 and 7503 [TR030008/APP/6.4]**), with a few small clusters or ‘hotspots’ present. In many ways, these results are unsurprising and simply confirm that at one time marsh land extended out beyond the current coastline.

14.6.74 In terms of other assets, the marine work did not identify any receptors which link directly to, or form part of the background or setting of, any terrestrial heritage asset identified as part of this work (and vice versa).

Archaeological Potential

14.6.75 This section assesses the potential for unknown buried archaeological remains and surface artefacts to be present within the Site Boundary. The assessment of archaeological potential is based on the data available at the time of assessment, which includes the results of the programme of archaeological evaluation works undertaken in early 2023 and described above. As a result of these investigations, the potential to uncover new, unknown archaeological remains is concluded to be generally low.

a. **Paleoenvironmental**: A generally moderate potential for encountering remains of this type, which if encountered would be of **local** and **regional archaeological interest** and of **medium value** based on their potential capacity to inform on past environments and land use.

b. **Early Prehistoric**: A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological interest** and of **low value** based on their potential capacity to inform on material culture (in the case of tools) as well as the economy and subsistence/agricultural practices of the time.

c. **Later Prehistoric**: A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological interest** and of **low value** based on their potential capacity to inform on material culture as well as the economic, and subsistence/agricultural practices of the time.

d. **Roman**: A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological** and potentially **historic interest** and of **low value** based on their potential capacity to inform on material culture as well as the economic, trade, industrial and subsistence/ agricultural practices of the time.

e. **Early Medieval**: A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological interest** and of **low value** based on their potential capacity to inform on material culture as well as the economic, trade, industrial and subsistence/agricultural practices of the time.

f. **Medieval:** A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological** and potentially **historic interest** and of **low value** based on their potential capacity to inform on material culture as well as economy, trade and industry (with particular reference to salt making), as well as the subsistence/agricultural practices of the time.

g. **Post Medieval**: A low potential for encountering remains of this type, which if encountered would likely be of **local archaeological** and potentially **historic interest** and of **low value** based on their potential capacity to inform on material culture as well as economy, trade and industry (with particular reference to salt making), as well as the subsistence/agricultural practices of the time.

h. **Late Post Medieval – Modern**: A moderate potential for encountering remains of this type, which if encountered would likely be of **local archaeological** and **historic interest** and of **low value** based on their potential capacity to inform on material culture, economic, and subsistence/ agricultural practices – with particular reference to land division and drainage – and the industrial development of the location.

Future Baseline

14.6.76 The future baseline is a prediction of baseline conditions in the future, assuming that the Project is not constructed. A review has been undertaken to determine how or whether the existing baseline conditions might change if the Project did not take place and thus considers other planned developments within the bounds of the Project.

14.6.77 Consideration was given to the following development-related changes that could potentially alter the historic environment in the future:

a. The partial or total loss of known or potential (unknown) buried archaeological resources within the Site Boundary or known above-ground assets within the study areas as a consequence of land being disturbed or developed.

b. Changes to the sensitivity (value) and significance of assets within the study area through the introduction of new development in their setting.

14.6.78 The review involved:

a. The identification of any permitted (i.e. consented) or other planned projects within the assessment study area that have yet to be implemented.

b. Analysis of the likely environmental effects and planned timescales for each identified project.

c. An assessment of the potential for each identified project to change the existing baseline conditions in the Construction Years (2025 – 2036) and the subsequent operational periods of the Proposed Developments (2028 – 2053), in the manner described.

14.6.79 Although a small number of other development projects are expected to form part of, and influence, the future conditions of the study areas, the review concluded that there would be no significant change to the form, character and appearance of the historic environment in this area. Fundamentally, in the absence of any other Project, parts of the Site will simply continue to be utilised for port activity within an already heavily industrialised landscape. As such, it is considered there will be no change to the future baseline for cultural heritage and that the baseline details as presented above are not anticipated to change in the absence of the Project.

14.6.80 Accordingly, the assessment presented in **Section 14.8** assesses the impacts of the Project against existing baseline conditions.

14.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

14.7.1 The Project has been designed, as far as is possible given the constraints of the Project, to avoid and minimise environmental impacts and effects through the process of design development, and mitigation measures embedded into the design. This includes:

a. Construction methods which will "do no harm" specifically deep Horizontal Directional Drilling ("HDD") associated with the Pipeline Corridor and "no impact" methodologies within the Temporary Construction Area as outlined within the **Outline CEMP [TR030008/APP/6.5]**.

b. The Site Boundary has been refined to optimise land take, (given the constraints of the Project requirements) in order to have as small a physical impact upon the assets in and around it, as possible.

Standard Mitigation Measures

14.7.2 A programme of archaeological evaluation has been undertaken in order to better understand the archaeological potential of the Site.

14.7.3 It is considered that the Project's impacts upon the buried archaeological resource at the Site have been further understood and clarified through a staged programme of archaeological works (see **Paragraph 14.7.4**), the purpose of was to ensure that any remains within the Site Boundary were identified, understood and recorded prior to construction activities commencing.

14.7.4 The first stage of these works has been completed and comprised a comprehensive programme of archaeological evaluation of the Site, as defined in the WSI (**Appendix 14.E [TR030008/APP/6.4]**). These works were developed in consultation with the Heritage Officer for NELC and comprised:

a. An archaeological trial trench evaluation, consisting of 107 trial trenches.

b. Archaeological monitoring (watching brief) of geotechnical investigations conducted across the Site.

c. A geoarchaeological borehole survey.

d. A geophysical survey of the temporary construction area at the eastern end of the Project.

14.7.5 A summary of the results of these works is presented within this chapter (**Paragraphs 14.6.56 – 14.6.70**) and the full reports are presented as **Appendices 14.F – 14.H [TR030008/APP/6.4]**.

14.7.6 The information gathered by these evaluation works, along with the data presented in the baseline, has been used to determine if any further archaeological mitigation works (such as further evaluation, monitoring and/or archaeological excavation and recording) are required. The need for, and nature of, these mitigation works has been determined, and agreed, in liaison with the Heritage Officer for NELC. These mitigation measures are presented in **Section 14.9** and are also detailed in the **Outline CEMP [TR030008/APP/6.5]**.

14.7.7 Further, if remains which are deemed to be significant in nature are encountered during the works, the relevant part of the works will be halted and NELC Heritage officer consulted in order to understand if further works are required in relation to the asset in order to characterise, record and understand it (**Outline CEMP [TR030008/APP/6.5]**).

14.8 Assessment of Likely Impact and Effects

Potential Impacts and Effects

14.8.1 This section presents an assessment of how construction, operation and decommissioning of the Project may result in impacts to terrestrial heritage assets.

14.8.2 Impacts to terrestrial heritage assets fall into two categories:

a. Direct impacts upon the asset. Typically impacts upon the physical remains of the asset, such as the total or partial truncation of the asset during construction activity.

b. Indirect impacts upon the asset. Impacts which may not directly affect the physical remains of the asset but rather have the potential to affect our understanding, appreciation and experience of the asset by altering its setting, for example the introduction of a new and visually intrusive element into the view scape of an asset. Such changes may occur during the construction phase but may also continue through the operational life of the Project. Additional, similar, impacts may also arise during the decommissioning of the Project.

14.8.3 The sections below provide details of the potential impacts associated with the Project during these phases.

Construction Phase Impacts (Years 1 – 11 (phased))

14.8.4 Temporary and short-term construction impacts lasting for all or part of the Project construction phase potentially include the following:

a. The presence and movement of construction plant and equipment, which may impact on the setting of heritage assets.

b. The siting of construction compounds and activities within working areas, including associated construction noise and lighting, which may impact on the setting of heritage assets.

c. The use of traffic management and increased volumes of traffic travelling on the local road network, which may impact on the setting of heritage assets.

14.8.5 Permanent construction impacts lasting beyond the Project construction phase potentially include the following:

a. Partial or total removal or truncation of known and/or unknown heritage assets by such activities as:

i The construction of piles, pile caps, ground beams and floor slabs.

ii Ground remediation.

iii Levelling of surfaces for formation of the temporary site facilities and the temporary construction areas.

iv Installation of any below ground surface water attenuation tanks/drains.

v The burial of pipes, cables and any other services or utilities.

b. Compaction of archaeological remains by construction traffic and structures.

c. Changes to local hydrology that could result in the drying out of underlying peat deposits and affect preservation levels of heritage assets.

d. Vibration effects during construction of the Project arising from increased traffic and construction activities.

e. Adverse effects on the setting of heritage assets arising from the presence of the Project in the landscape, for example visual intrusion, noise pollution, light pollution, severance, reduced access and reduced amenity.

Operational Phase Impacts (Year 3 or 4 onwards until decommissioning)

14.8.6 Project operation impacts lasting for all or part of the operational phase potentially include the following:

a. Permanent increase in such things as traffic movements, vibration, noise pollution and light pollution on and around the Site (maintenance traffic) which could affect the setting of heritage assets.

b. Long term impacts on hydrology and geology as a result of the permanent presence and operation of the Project (such as the raising or lowering of ground water levels and the diversion of underground aquifers).

14.8.7 The operation of the Project will not result in any additional land take or construction activities or other development, nor generate any other effects (such as light, noise and vibration) which are not present during construction or which are present at a worse level than as generated by the construction of the Project. As a result, it is not expected that the operation of the Project will result in any additional impacts, direct or indirect, to terrestrial heritage assets, other than those already identified during the construction phase, and that such impacts will not be worsened during operation. Assessment of the Project's impacts during construction therefore represents an assessment of the worst case for the assets affected by the Project.

14.8.8 There will not be any significant impact upon ground water levels or "through flow" across the Site following the construction of the Project (see **Chapter 18:Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**). As a result, those peat and organic alluvium deposits present at the Site, which are not directly impacted by the construction of the Project, will not be impacted by changes to hydrology.

Decommissioning Phase Impacts (excludes marine elements)

14.8.9 Project decommissioning impacts are likely to be similar to those temporary impacts experienced during the Project construction phase. Impacts lasting for all or part of the decommissioning phase of the Project potentially include the following:

a. The presence and movement of plant and equipment, which may impact on the setting of heritage assets.

b. The siting of compound and activities within working areas, including associated noise and lighting, which may impact on the setting of heritage assets.

c. The use of traffic management and increased volumes of traffic travelling on the local road network, which may impact on the setting of heritage assets.

14.8.10 Decommissioning of the Project is unlikely to result in additional temporary or permanent impacts on any terrestrial heritage asset, as decommissioning of the landside elements would likely involve only leaving underground pipelines and other underground elements of the Project *in situ* (see **ODEMP [TR030008/APP/6.6]**). All above ground infrastructure associated with the Project is anticipated to be dismantled and all material removed.

14.8.11 It is not expected that there would be any permanent impacts during Project decommissioning as it is not anticipated that there will be impacts beyond the already-disturbed footprint of the Project; therefore, it is not anticipated that decommissioning activities would have a direct physical impact upon archaeological remains nor any additional adverse impacts upon setting.

Assessment of Effects for the Historic Environment (Terrestrial) – Construction Phase

14.8.12 This section provides an assessment of the likely significant effects on the historic environment associated with the construction of the Project. As noted above the operation and decommissioning of the Project will not result in any additional impacts nor worsening of already identified impacts.

14.8.13 Only those heritage assets which are considered to experience an adverse or beneficial effect from the Project, as informed by the desk-based research and professional judgement, are discussed herein – whether the effect is significant or not. Those assets which will not experience an impact (adverse or beneficial) either physically or through changes to their setting, are omitted. Details of assets within the study areas, but not subject to adverse impacts by the Project, are presented in the Cultural Heritage DBA (**Appendix 14.A [TR030008/APP/6.4]**).

14.8.14 As noted earlier (**Paragraphs 14.4.20** and **14.4.21**) the assessment of potential impacts and effects has assumed that, for all assets recorded in the HER and that are within the Site Boundary, unless otherwise stated, 100% of the area within the Site will be physically affected by the Project. The impacts on applicable heritage assets listed below have been assessed accordingly. Any refinement to the Project design may reduce the currently defined impacts.

Designated Assets

14.8.15 No designated heritage assets have been identified as having the potential to experience significant effects (either direct or indirect) during any Project stage (refer to **Paragraphs 14.6.11 – 14.6.20**).

14.8.16 There are no World Heritage Sites, Scheduled Monuments, Grade I or II* listed buildings, conservation areas, registered parks and gardens or registered battlefields within the 2km study area for designated heritage assets.

14.8.17 There is a single Grade II listed building, located within the 2km study area, comprising of the Immingham War Memorial (**NHLE 1455139**, described at **Paragraph 14.6.12**). The asset is located at the junction of Humberville Road and Pelham Road, approximately 1.57km to the north-west of the Site, within Immingham, on the eastern edge of the town. The primary setting of the asset includes the small green area it is located within, with modern Immingham (consisting of residential houses and commercial properties) surrounding this on all sides, with Humberville Road and Pelham Road to the immediate north. It is set within the community it references. The asset is considered to have **medium heritage value**, derived from its **architectural** merit and **historic** interest associated with the World Wars. There will be very limited change to the setting of this designated asset as a result of the Project. It is sufficiently distant from the Project that the Project cannot be seen to form part of its primary setting. In addition, the combination of distance from the Project, topography and the buildings of intervening modern Immingham, mean that there is very limited change arising from the Project to the wider view scape of the asset (the views to the asset from its setting and from the asset across its setting). In any event, the wider setting of the asset has always been industrial Immingham with its ports and heavy industry. This was the case when it was unveiled and has remained the case as names have been added to the memorial over the decades; it has formed part of the evolving landscape. The addition of new areas of industrial development to the backdrop of this asset are simply a continuation of this evolution and do not detract from the significance of this asset. As a result, the Project will have a **very low** impact upon the view scape of the asset and / or its immediate or wider setting and our ability to appreciate, understand and experience the asset within its setting. This is assessed as a **negligible adverse effect**, which is **not significant**.

14.8.18 Beyond the 2km study area, there are a number of designated assets (listed buildings), as described at **Paragraphs 14.6.14 – 14.6.20** above.

14.8.19 Churchfield Manor (NHLE 1161630) is a Grade II listed building located on Church Lane on the northern edge of Immingham, bordered to the north by agricultural fields, to the east by Immingham Golf Course and by Immingham to the south. It is located approximately 2.7km north-west of the centre of the Site. The asset is considered to have **medium** heritage value stemming from **architectural** merit and **historic** interest as a 17th century vernacular farmhouse. There will be very limited change to the setting of this asset due to a combination of distance from the Project and interrupted views between the Project and the asset (the view between the Project and the asset would be largely obscured by topography, modern Immingham and Immingham Dock). The asset's primary

setting comprises the semi-rural area north of Immingham. This will not be directly impacted by the Project. Other than the introduction of additional industrial units within an already heavily industrialised landscape, wider views to and from the asset will remain largely unchanged by the Project. For these reasons, the Project is deemed to have a **very low** impact upon the asset's setting and our ability to appreciate, understand and experience the asset within its setting. This is assessed as a **negligible adverse effect**, which is **not significant**.

14.8.20 The Grade I Church of St Andrew (NHLE 1310011) is located 2.9km to the west of the centre of the Site on the north-west edge of Immingham. It is considered to have **high** heritage value, derived from **architectural, historic** and **archaeological** interest as a medieval parish church and is therefore deemed to be sensitive to change. The immediate setting of the church comprises the churchyard which is enclosed by mature trees and foliage, with its wider setting including open rural land to the north (including a golf course) and Immingham to the south. The setting of the asset will not be affected by the Project. It is located at a sufficient distance from the Project for it not to form part of the primary setting of the asset. This distance combined with topography, and obscuring factors such as intervening foliage and elements of Immingham itself also means that the Project will not impact upon the wider setting (or view scape) of the asset. As a result of these factors there will be no impact upon our ability to appreciate, understand and experience the asset within its setting. Therefore, the Project is assessed as having a **neutral effect** upon this asset, which is not considered further in this assessment.

14.8.21 The Iron Bungalow (NHLE 1391349) is a Grade II Listed Building located on Pelham Road, approximately 2.7km west of the centre of the Site, within Immingham itself (just to the south-west of the centre of the town). The asset is considered to have **medium** heritage value, stemming from its **architectural** and **historic** interest, utilising an unusual construction form and having an association with the construction of Immingham Dock. The asset's primary setting would have been the Dock with which it was associated, the other structures of emerging Immingham (including "Tin Town") and the largely open, rural landscape in which it was set (prior to the construction of the Dock and the growth of Immingham). However, the subsequent growth and development of Immingham has all but divorced the asset from this setting, there being no substantial, direct, views left between the asset and the Dock or industry with which the Dock is associated. Today the primary setting of the asset consists of urban Immingham. Neither the asset nor views from / to its setting will be affected by the Project due to a combination of distance from the Project and an already interrupted view scape. Therefore, the Project is assessed as having a **neutral effect** upon this asset, which is not considered further in this assessment.

14.8.22 The Church of St Peter and St Paul (NHLE 1346978) is a Grade II* listed building, which contains within its churchyard the remains of a Grade II listed stone standing cross (NHLE 1020023, also recorded as NHLE 1161697). The church and its churchyard (which includes the cross) are located on the north-west edge of the village of Stallingborough *c.*3.3km to the south-west of the centre of the Site. The assets are considered to have **high** heritage value,

derived from **architectural, historic** and **archaeological** interest as a post medieval church and churchyard cross, with some reuse of medieval masonry, and so are deemed sensitive to change. The primary setting of both assets comprises the churchyard, with their wider setting encompassing the parish of Stallingborough. Specifically this includes the rural landscape which surrounds the churchyard and within which post medieval elements can be seen, the extant village of Stallingborough to the immediate south (which also contains post medieval elements) and the earthwork remains of the medieval extent of Stallingborough which sits to the immediate west of the churchyard. The Project is at a sufficient distance from the assets that it is not considered to fall within the assets' primary or wider setting. The views of the Project from the assets and their immediate setting are shielded by trees and mature hedges which enclose the churchyard, this in combination with distance from the Project, the topography of the landscape and intervening developments, including the railway and A180 road means that there will only be very limited visibility, if any, of the Project from either asset and very limited change to the wider setting of the asset. As a result, the Project will not have an impact on our ability to appreciate, understand or experience either asset. Therefore, the Project is assessed as having a **neutral effect** upon these assets, which are not considered further in this assessment.

14.8.23 Stallingborough scheduled medieval settlement (NHLE 1020423) is located on the north-east of the village of Stallingborough *c*. 3.3km to the south-west of the centre of the Site. The asset is considered to have **high** heritage value, derived from **archaeological** and **historic** interest associated with a deserted section of the village and earthworks of a post medieval manor and formal gardens. The setting of the asset comprises of the parish of Stallingborough which includes the surrounding rural landscape, the above mentioned church and stone cross and the modern village of Stallingborough which has post medieval elements to it. As with the Church, the Project is at a sufficient distance from this asset that it is not considered to fall within the assets' wider setting. Additionally, view scape of the asset will not be affected by the Project as the Project is obscured from it by a combination of distance, topography and intervening hedgerows and developments, including the railway and A180. This means that the Project will only be very minimally visible, if at all, from the asset and will only minimally impact the view scape of it or its setting. As a result, the Project will not impact on our ability to appreciate, understand or experience the asset. Therefore, the Project is assessed as having a **neutral effect** upon this asset, which is not considered further in this assessment.

Non – Designated Assets

14.8.24 There are 17 non-designated heritage assets recorded in the 1.6km study area that have the potential to be subject to physical impacts or impacts arising from a change to their setting as a result of the construction of the Project (for details of the assets refer to **Paragraphs 14.6.21 – 14.6.50**). Effects upon these non-designated assets are summarised below.

14.8.25 **Kings Road (MNL3523)** relates to the historic route of Kings Road, also seen on the OS maps of 1887 – 1889 a section of which survives today as part of the

route of modern Kings Road. It can be considered to be of **local** interest, derived from its **archaeological** and **historic** interest as part of the landscape, prior to the industrialisation of the area with the construction of the port in the early 20th century, It is assessed as of **low value** based on its capacity to inform on historic communication routes.

14.8.26 The original setting of this asset would have been the rural, post medieval landscape through which it ran. Very little of this remains today having been replaced by the Dock, heavy industry and the residential and commercial buildings associated with modern Immingham. An open area adjacent to the south-west of the road may contain traces of this post medieval landscape and forms part of the immediate setting of the historic route of the road. The wider setting of the historic route would also have included the nearby contemporary asset of 'Long Strip'. However, modern industrial, residential and commercial developments as well as a reduction in the size of the woodland, from its post medieval extent, mean that the road and the woodland have effectively become disconnected. There is no longer any visibility between the assets.

14.8.27 The works associated with the Project at this location are simply the temporary removal of street furniture and alterations to overhead cables to allow the passage of abnormal loads along Kings Road to the Site. This will have no direct or indirect impact upon the historic route of the road. The construction of the Project as a whole will add a number of new industrial buildings and structures into the current setting of the historic route and its wider view scape (setting). However, the current setting of the asset is not, largely, its original setting – it has evolved over time with the construction of the Dock and associated areas of industry. This Project is a continuation of this evolution and will merge into the existing industrial view scape and not be overly intrusive. Accordingly, the impact upon this asset is deemed to be **very low** resulting in a **negligible adverse effect**, which is **not significant**.

14.8.28 **Sea Defence Bank (MNL2085)** is known from OS maps dated 1887-1889, and consists of a series of linked, large, bank earthworks, which are still visible today around the area to the south and west of Immingham Dock. It is of **local** importance, derived from its **archaeological** and **historic** interest as part of the landscape, prior to the industrialisation of the area with the construction of the Port in the early 20th century. It is assessed as of **low value** based on its capacity to inform on past land use, and the protection of that land from inundation from the sea.

14.8.29 With reference to this Project, the stretch of the Sea Defence Bank which once did exist within the Site Boundary of the Project (within the Pipeline Corridor), has been entirely removed by the construction of the new Border Control Post. Thus, the Project will have no direct physical impact upon this asset. However, the asset covers a larger area than just within the Site Boundary, extending southwards through, and beyond, the study areas. Within the 1.6km study area, the setting of this asset includes intervisibility to other sections of the asset as well as to the surviving elements of the post medieval landscape it would once have formed a significant part of. Today this includes the surviving element of 'Long Strip', an area of open land to the immediate south of Queens Road

(through which a surviving stretch of the bank runs) and the North Beck Drain (*c.*420m to the south of Queens Road). The Project may have a significant impact upon 'Long Strip' (see below) but will not directly impact the area to the south of Queens Road nor North Beck Drain. Much of the rest of the rural landscape which would have formed the setting of this asset has now been replaced by Immingham Dock and areas of heavy industry. These now act as the primary backdrop to what remains of the original setting of the historic Sea Defence Bank and the Project will cause little change to the existing industrial landscape of this area. Accordingly, there will be little impact upon the extant setting of the stretches of this asset which survive within the study area, but beyond the Site Boundary. The impact of the Project upon this asset is assessed as **very low** resulting in a **negligible adverse effect**, which is **not significant**.

14.8.30 **Long Strip (MNL1797)** is a post medieval plantation marked on the OS 1887 – 1889 25 inch to 1 mile maps. It is of **local** interest, derived from its **archaeological** and **historic** interest as part of the landscape, prior to the industrialisation of the area with the construction of the port in the early 20th century. It is assessed as of **low value** based on the potential to inform on past land use and how this has changed over time. The southern part of Long Strip, south of Laporte Road, sits within the Site Boundary but will not be subject to any direct physical impacts by the Project. It is included in order to allow the Applicant to temporarily remove informal access during the construction phase of the Project. The section of Long Strip to the north of Laporte Road is within the area of the Site where the Pipe Rack and Jetty Access Road are proposed. This section of the woodland will be subject to direct physical impacts associated with the construction of the jetty access road and the above ground pipe rack, which will permanently remove a portion of the woodland. This is assessed as having a **high** magnitude of impact upon the asset resulting in a **moderate adverse effect** which is **significant**.

14.8.31 **Post medieval/modern beacons in Stallingborough (MNL4263 and MNL4426)** are recorded on the 1887 – 1889 OS map on the edge of the Sea Defence Bank. It is unclear from the records whether this is the site of two separate beacons, or the same beacon, whose location has been inaccurately recorded across a series of maps. Regardless, both assets have no extant above ground remains, and the extent of the survival of any below ground remains is unknown, although the geophysical survey of this area has identified a linear anomaly which may be associated with MNL4426 (**Appendix 14.H [TR030008/APP/6.4]**). The heritage value of such an asset type is derived from its **archaeological** and **historic** interest and its contribution to the maritime heritage of the area. They are both of **local** interest and the value of these assets are assessed as **low**. The assets sit within the proposed location of the Temporary Construction Area. The nature of the works in this area will be such that they will "do no harm" to any below ground archaeological assets, as outlined within the **Outline CEMP [TR030008/APP/6.5]** (see **Paragraph 14.9.3, bullet point 5**). Specifically, there will be:

a. No buildings other than containers and/or storage sheds.

b. No foundation or excavation work.

c. No topsoil removal.

d. Ground protection via matting or similar.

e. Issues of ground compaction to be mitigated again by use of suitable ground matting and other protection measures.

14.8.32 As a result, there will be no direct physical impact upon any surviving below ground remains of the assets.

14.8.33 The setting of the assets includes their relationship with each other (if there are two assets), the coastline, which they would have been associated with, and the open rural landscape in which they would have been located. The latter partially survives as the field in which the assets sit, Long Strip to the north, and areas of open ground to the immediate south-west. The Project will alter this setting. The buildings and stored materials within the Temporary Construction Area itself will affect visibility between the two beacon assets and will also reduce visibility between them, Long Strip and potentially the coast, as well as altering the immediate rural setting of the assets. These alterations will, however, only be temporary during the construction of the Project. A more permanent alteration to setting will be the partial loss of Long Strip and the introduction of new industrial buildings into the general view scape (setting) of the assets. Given the already heavily industrialised context and setting for the assets, this factor carries little weight when assessing the impact. Overall, the Project will have a **low** magnitude of impact on both of the assets through changes to their setting and our ability to understand appreciate and experience the assets, resulting in a **minor adverse effect** which is **not significant**.

14.8.34 Sections of the **Immingham Dock Branch Railway (MNL3039)** also lie within the Site Boundary. This branch line opened in 1912 along with the Dock and is still in use today (albeit with some alterations to the route having been made over the intervening century). The line can be seen as having **local** interest and **very low** heritage value. Its interest primarily lies in its **historic** contribution to the understanding of the development and use of the Dock and their impact upon the surrounding landscape. Whilst the rail line crosses through the proposed Pipeline Corridor, it is an active line which will not be subject to any direct physical impacts as a result of the construction or operation of the Project. The setting of the rail line, within the Site Boundary, is the industrial landscape. Whilst the Project may alter this slightly, adding new elements to the views from and to the rail line, it will not fundamentally alter the setting and will have no impact upon our ability to understand, appreciate and experience the asset. Accordingly, the Project will have a **very low** impact upon the setting of the asset resulting in a **negligible adverse effect** which is **not significant**.

14.8.35 Elements of **The Grimsby and Immingham Electric Light Railway ("G&IER") (MNL2087 and 3078),** which was in operation between 1912 – 1961 traverse through the Site. Much of this track has been removed, indeed there is no extant track relating to this tramway present within the Site Boundary. However, the route of the track is known from mapping and from its cuttings still being visible in the landscape. Within the Pipeline Corridor the proposed route of the pipe intersects with the known route of the tramway as it crosses Queens Road. Whilst no extant track is present, it is possible that below ground archaeological

remains associated with the tramway may still survive. Such remains are assessed as of **local** interest and **very low** heritage value, with interest lying in their **archaeological** and **historic** contribution to the understanding of the industrialisation of the landscape and the development of transportation networks (construction, use and closure), including its use in WWII and the immediate post-war period. The main pipelines will be installed via deep Horizontal Direction Drilling, and as such this work will have no impact upon the archaeological horizon. However, there is a possibility that a utility pipeline may need to be installed, and this will be installed as a *c.*1m wide trench cut along the length of the Pipeline Corridor (see **Outline CEMP [TR030008/APP/6.5**]). The installation of this would directly impact the archaeological horizon, and any surviving archaeological remains associated with the G&IER.

14.8.36 As with the Immingham Dock Branch Railway, the setting of this Electric Light railway, within the Site Boundary, is the industrial landscape through which it traverses. Again, whilst the Project may alter this slightly, adding new elements to the views from and to the rail line, it will not fundamentally alter the setting and will have no impact upon our ability to understand, appreciate and experience the asset. However, the direct physical impact from the utility pipeline does have the potential to permanently truncate, or completely remove, part or all of the remains associated with this asset. Accordingly, the Project has the potential for a **medium** impact upon the asset, resulting in a **minor adverse effect** which is **not significant**.

14.8.37 The site of a **Tram Shelter on Queens Road (MNL4715)** is located (just) within the Pipeline Corridor. It is the site of what was once a single storey building, with a rectangular footprint, that dated to *c.*1914 and which formed part of the G&IER. The building was demolished in 2021 with the construction of the new border control post and the associated upgrading of Queens Road. It is possible that below ground elements of the building survive. Such remains are assessed as of **local** interest and **very low** heritage value, with its interest lying in their **archaeological** and **historic** contribution to an understanding of the use of the transportation network. Again, there is the potential for these remains to be directly physically impacted by the placing of the utility pipeline (see **Outline CEMP [TR030008/APP/6.5]** for related construction methods), resulting in the permanent truncation, or complete removal of part or all of the remains associated with this asset.

14.8.38 The primary setting of any remains of the asset would be the remnants of the electric light railway and industrial Immingham, which the tram shelter served when it was active, the Project will alter this very little. As with G&IER remains, the Project has the potential to have a **medium** impact upon this asset – via direct physical impact, resulting in a **minor adverse effect** which is **not significant**.

14.8.39 It must be noted that the construction of the Border Control post in this area (Pipeline Corridor) in 2021 did not involve any archaeological assessment and has likely removed / heavily truncated any archaeological remains associated with the G&IER and Tram Shelter. A small, apparently undisturbed area of land on the south-east edge of the control post may have potential for archaeological survival of any below ground remains of the G&IER, but given the generally very disturbed area of land at this location this must been seen as a very low potential.

14.8.40 **Two rows of terraced properties (ACM1) located on the Queens Road** fall within the Site Boundary, adjacent to the West Site. The terraces date back to the early 20th century, likely built as accommodation for Dockworkers and their families contemporary to the construction of Immingham Dock. The assets are assessed as of **local** interest and to have **low** heritage value, their **historic** and **architectural** interest relating to the industrial development of the Dock and workers housing around the Dock. Whilst the properties do fall within the Site Boundary, they would not be demolished as part of the Project.

14.8.41 The properties are still, at least partially, in use today for a mix of residential and commercial purposes. Their setting is then the current modern aspect of the area, within which traces of the early 20th century landscape, contemporary with their construction, can be seen. This includes elements of Kings Road to the north-west, surviving open areas (such as the West Site, but also land to south, south-east and further to the west) and of course the Port itself to the immediate north. The construction of the Project will have an impact upon the setting of these assets. Whilst the primary aspect of the front of the buildings (view across to the Port) will remain unaltered, to their rear the open area which is currently the West Site will be transformed through industrial development. In addition to this change in character, the new buildings and structures and their use will create (both during its construction and operation) new visual, noise, vibration and light impacts on the assets and will affect views to/from Kings Road and the remaining open areas of land to the west and south. However, it must be remembered that the properties are part of a living, industrial landscape which has seen numerous other changes since the construction of these dwellings. Accordingly, these changes are seen as having a **medium** impact upon the setting of the assets and our ability to understand, appreciate and experience them, resulting in a **minor adverse effect** which is **not significant**.

14.8.42 The site of **World War II anti-landing obstacles (MNL4640)** is recorded in the HER as present within the West Site. In aerial photographs taken in 1940 the asset was visible as multiple lines of obstacles placed on a north-east to south-west orientation. Today there are no above ground remains of this asset, additionally both the geophysical survey undertaken at the Site in 2013 and the more recent (2023) trial trench evaluation (**Paragraph 14.6.56**) did not identify any anomalies which were thought to be associated with this asset. The asset is assessed as having **local** interest, deriving from its **archaeological** and **historic** contribution towards our understanding of the defence of the Port of Immingham during WWII. The value of this asset is assessed as **low**. Being located within the West Site, the asset would be subject to total or partial, permanent, truncation/ removal during the construction of the Project if present. However, work to date

strongly indicates that no below ground remains associated with this asset exist, and therefore it is incapable of being affected by the Project. This asset is not considered any further in this chapter.

14.8.43 The **probable site of a World War II bomb crater (MNL4643)** is located in the Temporary Construction Area. It was visible as an earthwork, *c.*8m in diameter, on aerial photographs taken in 1941 but has no visible remains today. However, recent geophysical survey work has identified an anomaly which may relate to this asset (**Appendix 14.H [TR030008/APP/6.4]**). The asset is assessed as being of **local** importance and of **very low** heritage value, derived from its **archaeological** and **historic** interest, contributing to our understanding of the impact of WWII on the landscape around the Port.

14.8.44 As noted above (**Paragraph 14.8.31**), the Project will not directly physically impact assets at this location. The setting of MNL4643 (possible WWII bomb crater) includes its relationship with other local assets relating to WWII and the fortification of the east coast, including MNL4651 (WWII Barrage balloon mooring site), the site of MNL4640 (anti landing obstacle) and MNL4644 (possible military installation). Whilst knowledge of these assets contributes to the experience and wider understanding of MNL4643, there is currently no intervisibility between any of these assets due to a combination of distance, topography and intervening features (such as buildings and woodland). The setting of MNL4643 includes the coastline as well as the open rural landscape in which it was located. It also includes the wider landscape of the Dock and industry which were the primary targets of the attack from which the asset was derived. Today the immediate setting of the asset comprises the field in which its sits, “Long Strip” woodland which is visible to the north, and areas of open ground to the immediate south-west. The wider landscape of the Dock and industry remain and whilst details have changed and evolved over time, the general use remains the same.

14.8.45 The Project will alter the asset’s setting. The buildings and stored materials within the Temporary Construction Area itself will affect visibility between the asset and Long Strip, and potentially the coast, as well as altering the immediate rural setting of the asset. These alterations to setting will, however, only be temporary during the construction of the Project. More permanent alterations to setting will arise from the partial loss of Long Strip, and the introduction of new industrial buildings into the general view scape of the asset. Given the already heavily industrialised context and setting for the asset, this factor carries little weight when assessing the impact. Overall, the Project is assessed as having a **low** magnitude of impact on the asset, in relation to its setting and our ability to understand appreciate and experience it, resulting in a **negligible adverse effect** which is **not significant**.

14.8.46 The **possible site of a World War II barrage balloon mooring (MNL4651)** is located within the East Site. It was visible as a military installation on aerial photographs taken in the 1940s where it consisted of a roadway leading to a circular structure with a second circular earthwork to the north-west. Nothing survives above ground today. The asset is considered to be of **local** importance and **low** heritage value – derived from its **archaeological** and **historic** interest, contributing towards our understanding of the defence of the Port of Immingham

during WWII. However all available data suggests that no below ground remains associated with this asset survive, having been removed by earlier construction works. As a result the asset is deemed incapable of being affected by the Project and is not considered any further in this chapter.

14.8.47 The **possible site of a World War II military installation (MNL4644)** is located at the end of the sea wall near the existing Immingham Oil Terminal Jetty. It was visible as a series of structures and earth features in aerial photographs until the 1950s. Nothing survives above ground today and the extent of any surviving below ground remains is unknown. The asset is of **local** importance and **low** heritage value – derived from its **archaeological** and **historic** interest, contributing towards our understanding of the defence of the Port of Immingham during WWII. There are no ground intrusive works planned within this area of the Site, which is included within the Site Boundary to enable informal access along the top section of the sea wall to be removed permanently, as it would be incompatible with the construction and operation of the jetty. As a result, the asset will not be subject to any direct physical impacts.

14.8.48 The setting of MNL4644 includes its relationship with other local assets relating to WWII and the fortification of the east coast, including MNL4643 (possible bomb crater), MNL4651 (site of a former WWII Barrage balloon mooring site) and MNL4640 (anti landing obstacle). Whilst knowledge of these assets contributes to the experience of MNL4644, there is currently no intervisibility between any of these assets due to a combination of distance, topography and intervening features (such as buildings and woodland) and lack of preservation above (and below) ground. The contemporary, immediate, setting of MNL4644 would have been that of an open, rural landscape to the south and east, the coastline it was defending to the immediate north, and with the Dock and areas of heavy industry (which it was built to defend) to the north and west. Whilst the Dock, areas of heavy industry and coastline remain, the areas of open land to the south and east have largely been replaced with further industrial development. Only Long Strip survives as a visible part of this once rural setting.

14.8.49 The Project will alter this setting, introducing new industrial buildings into the general view scape of the asset. However, given the already heavily industrialised back drop of the area this change will be minimal. Overall, the Project is assessed as having a **low** magnitude of impact on the asset, in relation to its setting and our ability to understand appreciate and experience the asset, resulting in a **minor adverse effect** which is **not significant**.

14.8.50 A **small rectilinear enclosure (MNL4652)** is visible as earthworks on aerial photographs, taken in 1941, in a field to the west of Queens Road, just outside of the Site Boundary. It is of uncertain function but has been dated to the 20th century. It is possible that this feature has been removed by modern development and the construction of hardstanding. Should it survive it would be of **local** interest and of **low** heritage value, its interest derived from its **archaeological** and **historic** contribution to the understanding of land use and change around the port in the 20th century. The asset does not sit within the Site Boundary and so only the setting of the asset may be impacted.

14.8.51 The mid- 20th century setting of this asset would have included open, agricultural land to the west, south and east (including Long Strip) and the Dock and industrial areas to the north. Industrial developments in the latter part of the 20th century, including industrial development of the land the asset is potentially located under, has significantly altered this landscape and little of the asset's contemporary rural setting survives. Long Strip remains, and is visible from the location of the asset, and open areas remain to the south of Queen Road, which are also at least partially visible from the location of the asset. Construction of the Project will have minimal impact on this setting. The eastern section of Long Strip, visible to the asset, is not being removed and views between the asset and the open areas to the south and Long Strip will only be minimally altered by the Project. New industrial buildings will be introduced into the general view scape of the asset. However, given the already heavily industrialised nature and back drop this change is assessed as minimal. As a result of this it is assessed that there will be a **low** magnitude of impact on the asset, in relation to its setting and our ability to understand appreciate and experience the asset, resulting in a **minor adverse effect** which is **not significant**.

14.8.52 A mid- 20th century landfill site **Immingham H.C.C Landfill (MNL1063)** is recorded on the southern edge of the West Site, the very northern extent of this asset overlapping with the southern boundary of West Site. The extent of the landfill is visible today as a series of earthworks and "scars". The location is now the site of Immingham Household Recycling Centre. Whilst the landfill is partially located within the Site Boundary, the proposal is to use the landfill access road, from Queens Road, for access to the Site. The asset itself would be physically unaffected by the Project. The asset can be seen as having **local** interest and being of **very low** heritage value, its interest derived from its **historic** contribution to the understanding of land use and change around the port in the 20th century. The immediate setting of the asset is the modern aspect present today, including Queens Road (from which the landfill site is accessed), the open agricultural land to the immediate north and west, industry to the immediate south and former industrial land to the east. Its wider setting includes the Dock and industrial areas to the north, south and east and Immingham, which it served to the west. Indeed, the site of the landfill itself – both with its former and current use – is a functional part of the 'industrial' landscape. Whilst the Project will alter the immediate setting of the asset, bringing industrial development more proximal to it, this does not fundamentally change the setting of the asset or have any impact upon our ability to understand, appreciate or experience the asset. The Project is assessed as having a **low** magnitude of impact on the asset, in relation to its setting and our ability to understand appreciate and experience the asset, resulting in a **minor adverse effect** which is **not significant**.

14.8.53 An **undated curvilinear enclosure (MNL4674)** is known from aerial photographs of 1942 and is located on the very northern edge of the West Site, extending into the Site but also beyond it to the north. No visible remains survive and it is unclear if any below ground archaeological remains extend into the bounds of the West Site. Should any survive, they would be of **local** interest and of **low** heritage value, interest being derived from their contribution to our understanding of the **archaeological** record of the area and likely the agricultural

use of the landscape of the period they relate to. Given the uncertain date of the feature it is not possible to understand what its contemporary setting would have been, what elements of this survive in the modern landscape and how these would contribute to an understanding and appreciation of the asset. Given its location, at least partially within the West Site, any surviving remains associated with this asset would be subject to permanent, partial, removal/truncation during the construction of the Project. This is assessed as a **medium** magnitude of impact, resulting in a **minor adverse effect** which is **not significant**.

Unrecorded Heritage Assets

14.8.54 Recent archaeological evaluation undertaken within the Site has uncovered a number of previously unknown archaeological assets. This section assesses the potential impact of the Project upon these, as they are currently understood.

14.8.55 Recent geoarchaeological work (**Appendix 14.G [TR030008/APP/6.4]**) has identified a number of **peat and organic rich alluvium deposits** scattered as pockets around the West Site. Depending upon how well preserved these deposits are, and the information they contain, they can be seen as having **regional** interest and as being of **medium** heritage value, their interest being derived from their potential to contribute to our understanding of the **archaeological** record of the area, our understanding of past environments and climate and how these evolved, and human communities use of, and influence over, the landscape. Given the location of these assets within the West Site they would be subject to at least partial removal/truncation by the construction of the Project. This is assessed as a **high** magnitude of impact, resulting in a **major adverse effect** which is **significant**.

14.8.56 Recent geophysical survey work (**Appendix 14.H [TR030008/APP/6.4]**) has identified a number of previously unknown **potential archaeological anomalies** within the Temporary Construction Area. This includes:

a. Several long, large linear features and one large rectangular feature. Given the known history of the area it is possible that these relate to WWII defensive features or earlier Beacons (e.g. MNL4426). However, other origins such as being derived from much earlier activity (e.g. Roman or medieval), or more modern activity (modern drainage/agriculture), cannot be ruled out.

b. Two small curvilinear ditch features were identified to the west of the Temporary Construction Area. These features may also, potentially, be archaeological in nature. However, the weak nature of the signal also means that a natural origin (variation in geology) for the anomalies cannot be ruled out.

c. Two large, ferrous, responses were also identified. These may relate to modern activity, or possibly a bomb crater recorded in the area by the HER (MNL4643).

d. Numerous linear trends were noted across the north of the Site, which may relate to past drainage or agricultural activity. To the south of the Site, strong geological responses appear to reflect the intertidal environmental and alluvial processes which have taken place across the Site.

14.8.57 Given the somewhat unknown nature of these assets, placing a value on them is difficult. They are likely to be of **local – regional** interest and as being of **low – medium** heritage value, their interest being derived from their potential to contribute to our understanding of the **archaeological** record of the area and the use of the landscape by human communities over time.

14.8.58 As previously noted (**Paragraph 14.8.31**) this area of the Site will not be subject to any intrusive ground works or anything which would create a direct physical impact upon below ground archaeological assets. Again, the uncertain nature of the features means relating them to their contemporary setting within the modern landscape is difficult; however, their setting is likely to be similar to that as described for **Beacons MNL4263 / MNL4426** and **Bomb Crater MNL4643** and to be affected in similar ways. Overall, the Project is likely to have a **low** magnitude of impact upon these assets in relation to their setting and our ability to understand appreciate and experience the assets, resulting in an overall **minor adverse effect** which is **not significant**.

Historic Landscape Character

14.8.59 The Historic Landscape Character of the Site is described in **Paragraphs 14.6.8 – 14.6.10**. The landscape of the Project is largely described as Other Industrial and Warehouse and Industrial, although areas of Modern Fields and Plantation Woodland are also present. The area is characterised as being dominated by industrial activity. As a whole, the historic landscape is considered to not be particularly sensitive to change and to be of **negligible – medium** value, with modern industrial areas within the Site being at one end of this spectrum and areas of preserved post medieval landscape, e.g. Long Strip being at the other. As a whole, the Project will have little impact upon the character of the historic landscape. It will change one area of modern field to industrial use and reduce the area of a post medieval plantation woodland. Some areas of the Project will have a **medium** impact upon the landscape – for instance the partial removal of Long Strip, whilst other areas will have a **low** (construction in the West Site within a modern field) or **very low** (Temporary Construction Area and development of already industrial area e.g. the East Site) impact. Overall, the Project is deemed to have a **low** magnitude of impact upon the historic landscape character, resulting in an overall **minor adverse effect** which is **not significant**.

Previously Unknown Heritage Assets

14.8.60 There is potential for previously unknown (unrecorded and unmapped) heritage assets to be present within areas of the Site which have not been subject to significant prior ground disturbance. Note that this is distinct from those assets which are *unrecorded*, but which are now known about via the archaeological evaluation explained in this Chapter.

14.8.61 The archaeological evaluation work undertaken to date ensures that there is only potential for unknown heritage assets to be encountered within the Pipeline Corridor, the Bridleway Along The Western Edge of the Temporary Construction Area, the East Site and the Pipe Rack and Jetty Access Road. However, given what we know of the Site from the evaluation works explained in this Chapter, and the DBA, the potential to encounter such unknown remains at all of these locations is assessed as **very low** to **low**.

14.8.62 Neither the sea wall nor the Kings Road Overhead Cables areas have been subject to any form of archaeological evaluation. However, as no construction or other ground intrusive works are planned for either of these areas there is **no** potential for unknown heritage assets to be encountered or impacted at these locations.

14.8.63 The working methodology to be employed within the Temporary Construction Area (see **Outline CEMP [TR030008/APP/6.5]**) will also ensure that no unknown below ground heritage assets are encountered within this area of the Site.

14.8.64 The working methodology to be employed within Pipeline Corridor (see **Outline CEMP [TR030008/APP/6.5**]) will reduce the potential to physically encounter unknown below ground heritage assets. Deep HDD for the main pipelines will mean that the archaeological horizon is not impacted by these works. There is the possibility that a utility pipeline may be placed in a trench cut from the surface, which therefore has the potential to physically impact unknown remains. However, this will have as small a footprint as possible (*c.*1m wide) and is running through an area of **very low** to **low** potential to contain unknown remains (see **Paragraph 14.8.61**).

14.8.65 As a result, there is **very low** to **low potential** that unknown remains associated with the medieval and post medieval agricultural use of the land may be present within the Site. Such assets would be of **local archaeological** and **historic** interest due to their potential to inform on the economy and land use of this pre-industrialised period and would be of **low** heritage value. The nature of the Project at these locations would mean that they would likely be subject to partial to complete truncation/removal resulting in a (near) total loss of heritage value. Whilst such an impact would seem to be high, the measures to be employed, should significant assets of this nature be uncovered, (as detailed at **Paragraph 14.7.7**) will reduce the impact to a **medium to low** magnitude of impact, resulting in a **minor adverse effect** which is **not significant**.

14.8.66 There is also **very low** to **low potential** that that unknown heritage assets relating to post medieval/modern industrial activity and infrastructure may also be present in the Site. Again, such assets would be of **local archaeological** and **historic** interest due to their potential to inform on the industrial use and development of the landscape, the development of infrastructure in the area as well as the local economy of the period(s) and how these aspects had changed from earlier periods. These assets would likely be of **low** heritage value. The nature of the Project at these locations would mean that they would likely be subject to partial to complete truncation/removal resulting in a (near) total loss of heritage value. Whilst such an impact would seem to be high, the measures to be employed, should significant assets of this nature be uncovered, (as detailed at

Paragraph 14.7.7) will reduce the impact to a **medium to low** magnitude of impact, resulting in a **minor adverse effect** which is **not significant**.

14.8.67 Unknown heritage assets associated with WWII and the fortification of England's East coast may also be present within the Site. The potential to encounter such remains is assessed as **very low** to **low,** and such assets would be of **local** importance and **low** heritage value – derived from their **archaeological** and **historic** interest and their contribution towards our understanding of the defence of the Port of Immingham. The nature of the Project at these locations would mean that they would likely be subject to partial to complete truncation / removal resulting in a (near) total loss of heritage value. Whilst such an impact would seem to be high, the measures to be employed, should significant assets of this nature be uncovered, (as detailed at **Paragraph 14.7.7**) will reduce the impact to a **medium to low** magnitude of impact, resulting in a **minor adverse effect** which is **not significant**.

Summary of Assessment of Likely Impacts and Effects

14.8.68 **Table 14-6** provides a summary of the significant effects of the Project upon historic environment (terrestrial) assets, taking into account the embedded mitigation measures detailed in **Section 14.7**. Significant effects are defined as moderate or major. The below indicates that there are two assets which will be subject to significant effects (**Major** or **Moderate adverse effects**) due to the impacts of the Project.

Table 14-6: Summary of Assessment – Likely Effects

Receptor Name	Receptor Location	Receptor Value	Description of Impact	Magnitude of Impact	Effect
Peat deposits and organic alluvial deposits identified by geoarchaeological evaluation	Within West Site	Medium	Partial or complete, permanent truncation/ removal of below ground remains	High	Major adverse (significant)
Long Strip (MNL1797)	Within East Site and Jetty Access Road and Pipeline Corridor	Low	Partial or complete, permanent truncation/ removal of below ground remains	High	Moderate adverse (significant)
Terraced properties on Queens Road (ACM1)	West Site	Low	Effect on setting	Medium	Minor Adverse (not significant)
Curvilinear enclosure (MNL4674)	West Site	Low	Effect on setting but also potential for direct physical impact leading to the partial or complete, permanent truncation/removal of below ground remains	Medium	Minor Adverse (not significant)
Remains of Grimsby and Immingham Electric Light Railway (MNL2087 and MNL3078)	Pipeline Corridor	Very low	Effect on setting but also potential for direct physical impact leading to the partial or complete, permanent truncation/removal of below ground remains	Medium	Minor Adverse (not significant)
Site of Tram Shelter (MNL4715)	Pipeline Corridor	Very low	Effect on setting but also potential for direct physical impact leading to the partial or complete, permanent truncation/removal of below ground remains	Medium	Minor Adverse (not significant)

Receptor Name	Receptor Location	Receptor Value	Description of Impact	Magnitude of Impact	Effect
Unknown Heritage Assets relating to the Medieval – Post Medieval agricultural use of the landscape	All land within Site Boundary	Low (likely estimate)	Potential for direct physical impact leading to the partial or complete, permanent truncation/ removal of below ground remains. If present would be flagged with Heritage officer for NELC and need for/nature of any mitigation measures discussed	Medium	Minor Adverse (not significant)
Unknown Heritage Assets relating to the Post Medieval - Modern industrial use of the landscape	All land within Site Boundary	Low (likely estimate)	Potential for direct physical impact leading to the partial or complete, permanent truncation/ removal of below ground remains. If present would be flagged with Heritage officer for NELC and need for/nature of any mitigation measures discussed	Medium	Minor Adverse (not significant)
Unknown Heritage Assets relating WWII activity in landscape	All land within Site Boundary	Low (likely estimate)	Potential for direct physical impact leading to the partial or complete, permanent truncation/ removal of below ground remains. If present would be flagged with Heritage officer for NELC and need for/nature of any mitigation measures discussed	Medium	Minor Adverse (not significant)
Archaeological features present within TCA as demonstrated by geophysical survey	TCA	Medium	Effect on setting (physical impacts mitigated by no-harm approach to construction)	Low	Minor Adverse (not significant)
Historic Landscape Character of Site and area around Site	Study Area	Medium	Alterations to character of landscape by the Project	Low	Minor Adverse (not significant)

Receptor Name	Receptor Location	Receptor Value	Description of Impact	Magnitude of Impact	Effect
Beacon at Stallingborough (MNL4263)	Temporary Construction Area	Low	Effect on setting (physical impacts mitigated by no-harm approach to construction)	Low	Minor Adverse (not significant)
Beacon at Stallingborough (MNL4426)	Temporary Construction Area	Low	Effect on setting (physical impacts mitigated by no-harm approach to construction)	Low	Minor Adverse (not significant)
Site of WWII military installation (MNL4644)	PROW along Jetty west of the TCA	Low	Effect on setting	Low	Minor Adverse (not significant)
Rectilinear enclosure (MNKL4652)	1km study area	Low	Effect on setting	Low	Minor Adverse (not significant)
Mid 20th Century landfill Site – Immingham H.C.C. landfill (MNL1063)	West Site	Very Low	Effect on setting, no works planned in area of the asset which would physically impact it	Low	Minor Adverse (not significant)
Site of WWII bomb Crater (MNL4643)	TCA	Very Low	Effect on setting (physical impacts mitigated by no-harm approach to construction)	Low	Minor Adverse (not significant)
Churchfield Manor (NHLE 1161630)	2km Study Area	Medium	Effect on setting	Very low	Negligible Adverse (not significant)
Immingham War Memorial (NHLE1455139)	2km Study Area	Medium	Effect on setting	Very low	Negligible Adverse (not significant)
Sea Defense Bank (MNL2085)	1 km Study Area	Low	Effect on setting	Very low	Negligible Adverse (not significant)

Receptor Name	Receptor Location	Receptor Value	Description of Impact	Magnitude of Impact	Effect
Kings Road (MNK3523)	Kings Road	Low	Effect on setting	Very low	Negligible Adverse (not significant)
Immingham Dock Branch Railway (MNKL3039)	Pipeline Corridor	Very low	Effect on setting – will not be directly physical impacted by the Project	Very Low	Negligible Adverse (not significant)
Stallingborough Medieval Settlement (NHLE1020423)	2km Study Area	High	Effect on setting	None	Neutral
Church of St Andrew (NHLE 1310011)	2km Study Area	High	Effect on setting	None	Neutral
Church of St Peter and St Paul (NHLE1346978)	2km Study Area	High	Effect on setting	None	Neutral
The Iron Bungalow (NHLE1391349)	2km Study Area	Medium	Effect on setting	None	Neutral
Site of WWII anti landing obstacle (4640)	West Site	Low	None as evidence indicates asset no longer exists	None	None
Site of WWII barrage balloon mooring point (MNL4651)	East Site	Low	None as evidence indicates asset no longer exists	None	None

14.9 Mitigation and Enhancement Measures

14.9.1 A programme of archaeological evaluation works has been undertaken across the Site during January to February 2023 (as detailed in **Paragraphs 14.6.55 – 14.6.70**). The scope of these archaeological works was set out in a WSI approved by the Heritage Officer for NELC (**Appendix 14.E**) and the individual reports on the works are presented as **Appendices 14.E – G [TR030008/APP/6.4]**. The purpose of these works was to enhance the baseline presented in this document and to further understand the potential for the presence of archaeological and paleoenvironmental remains across the Site, in order that suitable further works could be devised (where necessary) to mitigate impact from the Project upon them and/or enhancement opportunities be recognised and taken.

14.9.2 The trial trench evaluation did not demonstrate the presence of any significant archaeological remains within the West Site. The Geophysical Survey demonstrated the potential for previously unknown archaeological anomalies to be present within the Temporary Construction Area. The Geoarchaeological Evaluation resulted in a deposit model across the Project area, this (along with the monitoring of geotechnical works) demonstrated that, whilst the suspected paleochannel was not present, a number of peat and organic alluvial deposits were present. These have the potential to contain important information on past climate and paleoenvironmental change and the impact of human communities on the landscape.

14.9.3 Following the completion of this work, the reports detailing the results of the work were disseminated to the Applicant and the Heritage Officer for NELC. Subsequently, a meeting was held on 28 July 2023 involving the Applicant, AECOM and the Heritage Officer for NELC to discuss the results of these recent works and to determine appropriate next steps/mitigation measures. This meeting resulted in the following decisions regarding further archaeological in relation to the Project:

a. **West Site – Archaeology.** The evaluation work done to date suggests that this area has no/very low potential for buried archaeological remains. Accordingly, it was agreed that no further archaeological work is required at this location.

b. **West Site – Geoarchaeology.** The evaluation work to date suggests that the retained borehole samples of peat and organic alluvium have paleoenvironmental potential. It was agreed (following the recommendation from the specialist) that rather than conducting additional fieldwork, the samples retained from the evaluation be subject to further analytical work, and a report detailing the results of this work be prepared and submitted to AECOM who will review and then disseminate to the Applicant and the Heritage Officer for NELC for their review and approval (as included within the **Outline CEMP [TR030008/APP/6.5]**). No further field work is required.

c. **Pipeline Corridor**. The low potential for the survivability of below ground remains at this location, combined with the proposed working methodology (deep horizontal directional drilling - see **Paragraph 14.8.35**) means, despite the possibility of the construction of a cut utility pipe trench, it is considered unlikely that remains will be impacted even if present and it was agreed that no further archaeological work is required in this area.

d. **East Site.** The low potential for survivability of below ground archaeological remains, combined with the likely low value of such possible remains (WWII defence infrastructure) along with the difficulty of work in the area – given the current land use - means that it was agreed that fieldwork in this area would be disproportionately onerous on the Project taking account of the likely benefits. Accordingly, it was agreed that no further archaeological work is required in this area.

e. **Temporary Construction Area**. The recent geophysical survey indicated that there is the potential for unknown below ground archaeological remains at this location. However, the working methodologies for construction and construction associated activities at this Site will be designed so as to "do no harm" (see **Paragraph 14.8.31**) as outlined within the **Outline CEMP [TR030008/APP/6.5]**. With this commitment in place, it is agreed that no further archaeological works will be required as the potential remains will be preserved *in situ.*

f. **Piperack and Jetty Access Route**. Will be impacted by the work. Whilst a survey of the woodland, focusing on preserving the historic information of the woodland, could be undertaken, the potential usefulness of this was discussed at this meeting, and it was not certain how such a survey would differ from the work being undertaken as part of the ecological/environmental mitigation works (see **Appendix 8.F: Arboricultural Impact Assessment [TR030008/APP/6.4]** and **Outline CEMP [TR030008/APP/6.5]**). Following a further meeting between the Heritage Officer for NELC and the Tree Officer for NELC on the 7 August 2023 (*Pers Comm)* it was concluded that a separate historic survey would not add to those works, which would provide sufficient historical data in respect of the woodland, and that this work would be made available to the HER.

14.10 Assessment of Residual Effects

14.10.1 A summary of the residual effects of the Project, following implementation of the mitigation measures detailed above (**Section 14.9**) is presented in **Table 14-7** below.

14.10.2 Further analysis of the peat/organic alluvium deposits retained by the evaluation work (as included within the **Outline CEMP [TR030008/APP/6.5]**) will aid in our understanding of these deposits. This analytical work, on samples which were difficult to gain and would not have been sought if it were not for the Project, will be beneficial to our understanding of past climates, environments, and human use of the land across the Humber region. This is a benefit of the Project and when combined with the adverse effect on the peat deposits from the Project results in an overall **minor adverse** residual effect on this asset.

14.10.3 In terms of the residual effect on the Long Strip woodland, account is taken of the mitigation work (see **Appendix 8G: Arboricultural Impact Assessment [TR030008/APP/6.4]** and **Outline CEMP [TR030008/APP/6.5]**) in relation to the ecological and environmental impacts upon the woodland in concluding that the residual effect is **minor adverse** in nature (P**aragraph 14.9.3, bullet point 6**).

14.11 Summary of Assessment

14.11.1 This section summarises the residual effects of the Project upon the assets impacted by the Project, once the additional mitigation measures such as those detailed above have been taken into account.in relation to Significant effects. Additional mitigation measures are not considered to be required for non-significant effects. Residual **Significant** effects are defined as **Major** or **Moderate**. The data is presented in **Table 14-7**.

Table 14-7: Summary of Residual Effects

Asset	Value	Magnitude of impact	Significance of impact	Additional mitigation measures	Residual Effect
Long Strip (MNL1797)	Low	High	Moderate adverse (significant)	The work already being undertaken by the ecological/environmental teams (see **Appendix 8.F: Arboricultural Impact Assessment [TR030008/APP/6.4]** and **Outline CEMP [TR030008/APP/6.5]**) will provide mitigation for the impact upon the historical nature of the woodland. Accordingly, no additional work is required in relation to this impact	Minor adverse (not significant)
Peat deposits and organic alluvial deposits identified by Geoarchaeological evaluation	Medium	High	Major adverse (significant)	Further analysis of the peat and organic alluvium samples obtained by the evaluation and report produced detailing the results of this work (as included within the **Outline CEMP [TR030008/APP/6.5]**). Such work will provide useful information that would otherwise never been gained.	Minor adverse (not significant)
Terraced properties on Queens Road (ACM1)	Low	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Curvilinear enclosure (MNL4674)	Low	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)

Asset	Value	Magnitude of impact	Significance of impact	Additional mitigation measures	Residual Effect
Remains of Grimsby and Immingham Electric Light Railway (MNL2087 and MNL3078)	Very low	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Site of Tram Shelter (MNL4715)	Very low	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Unknown Heritage Assets relating to the Medieval – Post Medieval agricultural use of the landscape	Low (likely estimate)	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Unknown Heritage Assets relating to the Post Medieval - Modern industrial use of the landscape	Low (likely estimate)	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Unknown Heritage Assets relating WWII activity in landscape	Low (likely estimate)	Medium	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Archaeological features present within TCA as demonstrated by geophysical survey	Medium	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Historic Landscape Character of Site and area around Site	Medium	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)

Asset	Value	Magnitude of impact	Significance of impact	Additional mitigation measures	Residual Effect
Beacon at Stallingborough (MNL4263)	Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Beacon at Stallingborough (MNL4426)	Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Site of WWII military installation (MNL4644)	Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Rectilinear enclosure (MNKL4652)	Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Mid 20th century landfill Site – Immingham H.C.C. landfill (MNL1063)	Very Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Site of WWII bomb Crater (MNL4643)	Very Low	Low	Minor Adverse (not significant)	N/A	Minor Adverse (not significant)
Churchfield Manor (NHLE 1161630)	Medium	Very low	Negligible Adverse (not significant)	N/A	Negligible Adverse (not significant)
Immingham War Memorial (NHLE1455139)	Medium	Very low	Negligible Adverse (not significant)	N/A	Negligible Adverse (not significant)
Sea Defense Bank (MNL2085)	Low	Very low	Negligible Adverse (not significant)	N/A	Negligible Adverse (not significant)

Asset	Value	Magnitude of impact	Significance of impact	Additional mitigation measures	Residual Effect
Kings Road (MNK3523)	Low	Very low	Negligible Adverse (not significant)	N/A	Negligible Adverse (not significant)
Immingham Dock Branch Railway (MNKL3039)	Very low	Very Low	Negligible Adverse (not significant)	N/A	Negligible Adverse (not significant)
Stallingborough Medieval Settlement (NHLE1020423)	High	None	Neutral	N/A	Neutral
Church of St Andrew (NHLE 1310011)	High	None	Neutral	N/A	Neutral
Church of St Peter and St Paul (NHLE1346978)	High	None	Neutral	N/A	Neutral
The Iron Bungalow (NHLE1391349)	Medium	None	Neutral	N/A	Neutral
Site of WWII anti landing obstacle (4640)	Low	None	None	N/A	None
Site of WWII barrage balloon mooring point (MNL4651)	Low	None	None	N/A	None

14.12 Conclusions

14.12.1 The Project occupies an area of relatively low archaeological significance. The HER records a number of assets within and around the Site which are largely of Post Medieval/Modern date, which relate to the industrial development of the Dock and the WWII defence of the east coast of Britain. On the whole, these assets are deemed to be of typically low value and local interest. On top of this the area is very active and has been subject to various construction or other ground penetrative works over the years – most recently the construction of the Border Control Post. This means that the potential for below ground archaeological remains to survive is thought to be generally low (**low** to **very low**).

14.12.2 A recent programme of archaeological works appears to at least partially confirm this lack of archaeological presence. It has been established that suspected salterns, paleochannels and WWII remains within the West Site are not present. However, the same programme of works was successful in identifying both known (a possible bomb crater) and unknown remains (a series of enclosures) via geophysical survey of the Temporary Construction Area, indicating that where the ground intrusive activities have not taken place and so the ground has remained undisturbed over the years, some potential for unknown remains survives. The work also demonstrated geoarchaeologial potential in the deep deposits of the West Site – identifying peat and organic alluvial layers.

14.12.3 Across much of the Site the potential for archaeological remains to actually be physically present is considered to be very low to low. Taking this into account, and following the recent programme of archaeological evaluation and a subsequent meeting with the relevant authorities and stakeholders, further archaeological field work to offset the impacts of the Project upon archaeological remains is not considered necessary. Where cultural assets may be present the potential impact of the Project on these will be mitigated via a combination of engineering and analytical means ("do no harm" methods of work as outlined within the **Outline CEMP [TR030008/APP/6.5]**).

14.12.4 Within the Temporary Construction Areas, a method of work which will "do no harm" to the buried archaeology present will be employed (as outlined within the **Outline CEMP [TR030008/APP/6.5**]) – either directly (via excavation) or indirectly (e.g. compaction). Alternate "do no harm" methods of work will also be employed within the Pipeline Corridor, i.e. deep HDD for the main pipelines.

14.12.5 Whilst no further archaeological fieldwork is required, further (laboratory) analysis of the peat and organic alluvium collected by the recent geoarchaeological evaluation will mitigate against direct impact of the Project on these underlying deposits (as outlined within the **Outline CEMP [TR030008/APP/6.5**]).

14.12.6 A historic Post Medieval plantation woodland (Long Strip) exists within the footprint of the Site and will be impacted by the Project - sections of the woodland are proposed to be cut down. As described in **Appendix 8F: Arboricultural Impact Assessment [TR030008/APP/6.4]** and the **Outline CEMP [TR030008/APP/6.5]** a survey of the woodland will be undertaken which will aim to preserve a record of the woodland and so mitigate the impact of the Project upon it.

14.13 References

Ref 14-1 AECOM (2022a) Immingham Green Energy Terminal, Heritage Desk-Based Assessment.

Ref 14-2 AECOM (2022b) Immingham Green Energy Terminal: Written Scheme of Investigation for GI Watching Brief, Geoarchaeological boreholes, Geophysical Survey and Archaeological Trial Trenching.

Ref 14-3 Ancient Monuments and Archaeological Areas Act 1979 (as amended).

Ref 14-4 British Geological Survey Geology of Britain viewer - British Geological Survey (bgs.ac.uk)

Ref 14-5 Bunn, D. 2013 Archaeological Geophysical Survey. Land at Immingham, North East Lincolnshire. Report prepared for Pre-Construct Archaeological Services Ltd by Pre-Construct Geophysics Ltd.

Ref 14-6 CIFA 2022 Code of Conduct.

Ref 14-7 CIfA (2020) Standard and Guidance for Archaeological Field Evaluation. Chartered Institute for Archaeologists, Reading, June 2020.

Ref 14-8 Department for Transport, 2012. National Policy Statement for Ports (NPSfP).

Ref 14-9 Department for Business, Energy and Industrial Strategy (Draft) 2021 National Policy Statement for Energy (NPS – EN1).

Ref 14-10 East Inshore and East Offshore Marine Plans 2014, updated 2022.

Ref 14-11 ECUS Ltd (2013) Kings Road Immingham: Desk Based Assessment.

Ref 14-12 Historic England (2015) Historic Environment Good Practice Advice in Planning Note 1, The Historic Environment in Local Plans.

Ref 14-13 Historic England (2015) Historic Environment Good Practice Advice in Planning Note 2, Managing Significance in Decision-Taking in the Historic Environment

Ref 14-14 Historic England (2016) Preserving Archaeological Remains. Decision-taking for Sites under Development.

Ref 14-15 Historic England (2017) Historic Environment Good Practice Advice in Planning Note 3, The Setting of Heritage Assets, 2nd edition.

Ref 14-16 Historic England (2019) Statements of Heritage Significance: Analysing Significance in Heritage Assets. Historic England Advice Note 12.

Ref 14-17 Historic England (2021) Commercial Renewable Energy Development and the Historic Environment. Historic England Advice Note 15.

Ref 14-18 IEMA (2021) Principles of Cultural Heritage Impact Assessment in the UK.

Ref 14-19 Infrastructure Planning (Decisions) Regulations 2010.

Ref 14-20 Lincolnshire County Council Archaeology Handbook 2019.

Ref 14-21 Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework.

Ref 14-22 Ministry of Housing, Communities and Local Government (2021). Planning Practice Guidance.

Ref 14-23 North East Lincolnshire District Council (2018) Local Plan 2013 to 2032.

Ref 14-24 Planning (Listed Buildings and Conservation Areas) Act 1990.

Ref 14-25 Pre-Construct Geophysics 2011 Geophysical Survey: Land off Queen's Road, Immingham, North East Lincolnshire. Unpublished Report

Ref 14-26 The Soil Survey of England and Wales soil association mapping Mapping and understanding soil types across England and Wales (cranfield.ac.uk).

Ref 14-27 CIfA (2020). Standard and guidance for historic environment desk-based assessment. Chartered Institute for Archaeologists, Reading, October 2020.

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6.2 Environmental Statement

Chapter 15: Historical Environment (Marine)

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 15: Historic Environment (Marine)

Regulation Reference	APFP Regulation 5(2)(a)
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Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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15 Historic Environment (Marine)

15.1 Introduction

15.1.1 This chapter presents the findings of the assessment of the likely effects of the Project on the Historic Environment (Marine). This chapter covers the marine elements of the Project below mean high water springs ("MHWS").

15.1.2 For more details about the Project, including construction methodology, layout and life span, refer to **Chapter 2: The Project [TR030008/APP/6.2]**.

15.1.3 The following receptors have been taken forward as part of the assessment:

a. Seabed prehistory (for example, palaeochannels and other features that contain prehistoric sediment, and derived Palaeolithic artefacts e.g. hand axes).

b. Seabed features, including maritime receptors (such as shipwrecks and associated material including cargo, obstructions, and fishermen's fasteners) and aviation receptors (aircraft crash sites and associated debris).

c. Intertidal heritage receptors.

15.1.4 The interrelationships related to the potential effects on Historic Environment (Marine) and other disciplines are addressed in the following chapters:

a. **Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2]**.

b. **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

15.1.5 This chapter is supported by the following appendices **[TR030008/APP/6.4]**:

a. **Appendix 15.A**: Marine Archaeology Technical Report.

b. **Appendix 15.B**: Archaeological Written Scheme of Investigation.

15.1.6 This chapter is also supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 15.1**: Site Location and Study Area.

b. **Figure 15.2**: Palaeogeographic features of archaeological potential.

c. **Figure 15.3**: Palaeogeographic feature data example – 7502.

d. **Figure 15.4**: Seabed features of archaeological potential.

e. **Figure 15.5**: Data examples of archaeological potential.

15.2 Consultation and Engagement

15.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the marine historic environment assessment, and the approach and methods to be followed. The Scoping Report records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the **Project on the Historic Environment (Marine)** (**Appendix 1.A [TR030008/APP/6.4]**).

15.2.2 The report was submitted to the Planning Inspectorate ("PINS") with a request for a Scoping Opinion from them on behalf of the Secretary of State.

15.2.3 Following receipt of the Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) as to the information to be provided in the Environmental Statement ("ES") (see **Table 15-1**), there were no additional requirements identified by the Planning Inspectorate which must be taken into account as part of the ongoing Marine Historic Environment assessment. Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) confirmed the Applicant's view that significant effects to the setting of marine cultural heritage receptors are unlikely and that impacts on marine archaeology as a result of disposal of dredge arisings are subject to a different regulatory regime. In this context, impacts from the disposal of dredged material have been scoped out as it will take place at already licensed marine disposal sites that have been characterised for this purpose. Accordingly, these matters have remained scoped out of consideration in the ES.

15.2.4 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008. The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

15.2.5 As a result of consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July in accordance with the Planning Act 2008 and a PEI Report Addendum was publicised to support the consultation.

15.2.6 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4])** and in response to the formal consultation and other pre-application engagement is summarised in **Table 15-1**. The full responses to consultation comments are included within the Summary of Consultation Responses document [**TR030008/APP/5.1**].

Table 15-1: Stakeholder consultation on Historic Environment (Marine)

Consultee	Reference/Date	Summary of Response	How comments have been addressed in this chapter
Planning Inspectorate	Scoping Opinion, 10 October 2022	The Scoping Report proposed to scope out impacts to the setting of marine archaeological and cultural heritage receptors, as given the existing industrial character of the Site, the Applicant considered it unlikely for there to be any material additional impacts on the setting of known and unknown heritage receptors during construction or operation. Given the context of the existing baseline environment, the Inspectorate agreed that significant effects to the setting of marine heritage receptors are unlikely to occur, and this matter was scoped out.	Noted, the assessment of impacts to the setting of marine cultural heritage receptors is scoped out.
	Scoping Opinion, 10 October 2022	The Scoping Report proposed to scope out impacts on marine archaeology as a result of disposal of dredge arisings, as this activity would take place at licensed marine disposal sites that have been characterised for this purpose, and any heritage conditions associated with the use of such sites would be adhered to. Given the receiving locations and regulatory regime in place, the Inspectorate agreed that this matter could be scoped out of the ES.	Noted, the impacts on marine archaeology as a result of disposal of dredge arisings are scoped out.
Historic England	Scoping Opinion, 10 October 2022	Historic England were in general agreement regarding the content of the Scoping Report (AECOM: August 2022) and the areas of the Historic Environment which are to be scoped in and out of the assessment. Historic England explained the importance of making sure that the area of the terrestrial and maritime heritage assessments abut or overlap so that no assets are missed and the setting of assets can be assessed as a whole.	The marine historic environment assessment has assessed the impact on heritage receptors up to MHWS (see **Paragraph 15.5.1**). This abuts the spatial limit of the terrestrial heritage assessment creating a continuous archaeological assessment across the study area, eliminating the potential for assets to be overlooked.
	Scoping Opinion, 10 October 2022	This development could, potentially, have an impact upon a number of designated and un-designated terrestrial and maritime heritage assets and their settings in the area around the site. In line with the advice in the	Response relevant to and addressed in the terrestrial heritage assessment (refer to

Consultee	Reference/Date	Summary of Response	How comments have been addressed in this chapter
		National Planning Policy Framework (NPPF), Historic England would expect the ES to contain a thorough assessment of the likely effects which the proposed development might have upon those elements which contribute to the significance of these assets. Given the heights of the structures associated with the proposed development and the surrounding landscape character, this development is likely to be visible across a very large area and could, as a result, affect the significance of heritage assets at some distance from this site itself. Historic England would expect the assessment to clearly demonstrate that the extent of the proposed study area is of the appropriate size to ensure that all heritage assets likely to be affected by this development have been included and can be properly assessed.	**Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2])**.
	Statutory Consultation – January 2023	Historic England noted the proposed terrestrial and marine investigations and considered it premature to conclude environmental impacts in respect of marine and / or terrestrial archaeological remains/wrecks being classed as less than significant post-mitigation when sufficient survey and deposit modelling work has not yet been carried out/shared.	A full technical assessment of Project marine geophysical and available geotechnical survey data has been undertaken and supports the baseline enhancement for this chapter (**Appendix 15.A**).
		As noted in Historic England's scoping advice, it is important to regard the divide between marine and terrestrial as only the present day boundary and for investigations across this to be well integrated reflecting the shifting relationship through past centuries and millennia in which deposits were formed. Regarding marine surveys, we look forward to seeing the results of geophysical survey and deposit modelling to provide a more informed understanding both of ancient deposits/remains and the location, significance and importance of wrecks. Again it appears premature to cap the potential impact of capital dredging before this work is done since only with a sound undertaking of the resource potential can mitigation through exclusion areas, depth limits and excavation be modelled.	As above. An integrated approach to the marine and intertidal areas has been undertaken with AECOM throughout this chapter, particularly with reference to geoarchaeology and reference is made between this interrelationship and the requirement to read the terrestrial chapter (**Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2]**) alongside the marine chapter (see **Paragraph 15.6.9**).

15.3 Legislation, Policy and Guidance

15.3.1 **Table 15-2** presents the legislation, policy and guidance relevant to the marine historic environment assessment and details how their requirements have been met.

Table 15-2: Relevant legislation, policy and guidance regarding Historic Environment (Marine)

Legislation/Policy/Guidance	Consideration within the Environmental Statement
The Marine and Coastal Access Act 2009 ("MCAA") (Part 4) (Ref 15-21)	
Part 4 of the Marine and Coastal Access Act 2009 is relevant to marine development within English territorial waters, implementing a requirement for a marine licence for carrying out certain licensable marine activities (see **Section 15.3**). Whilst the MCAA regulates marine licensing for works at sea, section 149A of the Planning Act 2008 enables an applicant for a Development Consent Order ("DCO") to include within the Order a Marine Licence which is deemed to be granted under the provisions of the MCAA.	Information relevant to the marine licensing process is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**).
Protection of Wrecks Act 1973: Sections 1 and 2 (Ref 15-22)	
It is an offence to carry out certain activities in a defined area surrounding a wreck that has been designated, unless a licence for those activities has been obtained from the Government.	There are no protected wrecks within the study area (see **Section 15.6**).
Ancient Monuments and Archaeological Areas Act 1979 Section 2 (Ref 15-23)	
It is a criminal offence to carry out any works on, or near to, a Scheduled Monument without Scheduled Monument Consent. Both terrestrial and maritime sites, including wrecks, may be designated under this Act.	There are no scheduled ancient monuments within the study area (see **Section 15.6**).
Protection of Military Remains Act 1986 (Ref 15-24)	
This Act provides protection for the wreckage of military aircraft and designated military vessels. The Act provides for two types of protection: 'protected places' and 'controlled sites'. Military aircraft are automatically protected, although vessels have to be specifically designated. The primary reason for designation is to protect as a 'war grave' the last resting place of servicemen;	There are no protected places or controlled sites within the study area (see **Section 15.6**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
however, the Act does not require the loss of the vessel to have occurred during the war.	
Merchant Shipping Act 1995 (Ref 15-25)	
All wreck material recovered from UK waters must be declared to the Receiver of Wreck who acts to settle questions of ownership and salvage. 'Wreck' refers to all items of flotsam, jetsam, derelict, and lagan found in or on the shores of the sea or any tidal water. Any wreck material recovered during the Project will have to be reported to the Receiver of Wreck and stored and disposed of according to their instructions.	Enhanced baseline characterisation relevant to the Act has been undertaken (**Section 15.4**) and in principle mitigation measures, such as a Protocol for Archaeological Discoveries supports the requirements of the Act.
Treasure Act 1996 (Ref 15-26)	
Any material classed as treasure found during the Project must be reported to the Coroner. This includes gold and silver objects, groups of coins, and prehistoric base-metal assemblages. All information required by the Treasure Act (i.e., finder, location, material, date, associated items etc.) will be reported to the coroner within 14 days.	Enhanced baseline characterisation relevant to the Act has been undertaken (**Section 15.4**) and in principle mitigation measures, such as a Protocol for Archaeological Discoveries supports the requirements of the Act.
National Policy Statement for Ports ("NPSfP") (Ref 15-5)	
The NPSfP recognises the importance of the historic environment and that the construction, operation and decommissioning of port infrastructure has the potential to result in adverse impacts on it (Section 5.12.1). Therefore, the significance of heritage assets and the extent of the impact of the proposed development on the significance of any heritage assets has to be understood (Section 5.12.9). Both designated heritage assets and undesignated heritage assets have to be considered, and the setting of a heritage asset also has to be taken into account. The NPSfP advises that the ES should include: • a description of the significance of the heritage assets affected by the proposed development and the contribution of their setting to that significance. As a minimum, the applicant should have consulted the relevant HER and assessed the heritage assets themselves using expertise where	Information relevant to the policy has been undertaken including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
necessary according to the proposed development's impact. (Section 5.12.6); • appropriate desk-based assessment and, where such desk-based research is insufficient to properly assess the interest, a field evaluation (Section 5.12.7); • consideration of the possibility of damage to buried features from underwater disposal of dredged material (Section 5.12.8); and • an assessment of the extent of the impact of the proposed development on the significance of any heritage assets affected (Section 5.12.9). The NPSfP also advises that the assessment should take account of other relevant UK policies and plans, including the Marine Policy Statement (MPS) and any existing marine plans provided for by the MCAA 2009 (Section 4.1.1).	
National Planning Policy Framework ("NPPF") (Ref 15-17)	
As part of the NPPF, a core planning principle is to conserve heritage receptors in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations (Ministry of Housing, Communities and Local Government, 2021). Section 16 of the NPPF, entitled 'Conserving and enhancing the historic environment', sets out the principal national guidance on the importance, management and safeguarding of heritage assets within the planning process. The NPPF does not contain specific policies for nationally significant infrastructure projects, but it may be a material consideration in DCO applications (Ref 15-16, para. 5)	Information relevant to the policy is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
North East Lincolnshire Local Plan 2013 to 2032 (Ref 15-18)	
The North East Lincolnshire Local Plan, adopted in 2018, recognises the significant role the historic environment plays in providing a "sense of community identity and local distinctiveness, and enhance the aesthetic, social and cultural quality of life available to residents" (p. 218). Policy 39 "*Conserving and enhancing the historic environment' states that Proposal for*	Information relevant to the policy is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
development will be permitted where they would sustain the cultural distinctiveness and significance of North East Lincolnshire's historic urban, rural and coastal environment by protecting, preserving and, where appropriate, enhancing the character, appearance, significance and historic value of designated and non-designated heritage assets and their settings" (p.220). Furthermore, *"Where a development proposal would affect the significance of a heritage assets (whether designated or non-designated), including any contribution made to its setting, it should be informed by proportionate historic environment assessment and evaluations".* This is undertaken by: • *"identifying all heritage assets likely to be affected by the proposal;* • *explain the nature and degree of any effect on elements that contribute to their significance and demonstrating how, in order of preference, any harm will be avoided, minimised, or mitigated;* • *provide a clear explanation and justification for the proposal in order for the harm to be weighed against public benefits; and,* • *demonstrate that all reasonable efforts have been made to sustain the existing use, find new uses, or mitigate the extent of the harm to the significance of the asset; and whether the works proposed are the minimum required to secure the long-term use of the asset."*	
UK Marine Policy Statement ("MPS") (Ref 15-14)	
The MPS was adopted by all UK Administrations in March 2011 as part of a new system of marine planning then being introduced across UK seas. The statement facilitates the formulation of Marine Plans, ensuring that marine resources are used in a sustainable way in line with high level marine objectives. Under the MCAA, England was divided into marine planning regions, with an associated authority responsible for preparing a Marine Plan for that area. The MPS sets out the framework for preparing Marine Plans and	Information relevant to the plan's policy is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
making decisions affecting the marine environment. The MPS also states that Marine Plans must ensure a sustainable marine environment that will protect heritage receptors. The relevant Marine Plan for the Project is the relevant Marine Plan is the *East Inshore Marine Plan* (Ref 15-4)	
East Inshore Marine Plan (Ref 15-4)	
The Marine Management Organisation (MMO) have divided the inshore and offshore waters around England into 11 plan areas for which marine plans are to be produced. The proposed development is within the East Inshore Marine Plan Area which has been adopted as of April 2014. The East Inshore Marine Plan Policy SOC2 states that proposals that may affect heritage receptors should demonstrate, in order of preference: • that they will not compromise or harm elements which contribute to the significance of the heritage asset; • how, if there is compromise or harm to a heritage asset, this will be minimised; • how, where compromise or harm to a heritage asset cannot be minimised, it will be mitigated against; or • the public benefits for proceeding with the proposal if it is not possible to minimise or mitigate or compromise the harm to the heritage asset.	Information relevant to the plan's policy is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Managing Lithic Scatters: Archaeological Guidance for planning authorities and developers (Ref 15-6)	
Guidance for planning authorities and developers in case of the discovery of archaeologically significant lithic material.	Assessment has been undertaken following guidance note.
Military Aircraft Crash Sites: Guidance on their significance and future management (Ref 15-7)	
This provides archaeological guidance regarding the significance and future management of military aircraft crash sites. It outlines the importance of aircraft crash sites and indicates that they should be considered	Assessment has been undertaken following guidance note (**Section 15.4**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
where they are affected by development proposals.	
The Code of Practice for Seabed Developers (Ref 15-15)	
This voluntary code provides a framework for seabed developers similar to the principles found in current policy and practice on land. The aim of the Code is to ensure a best practice model for seabed development. The Code offers guidance to developers on issues such as risk management and legislative implications.	Information relevant to the guidance note is provided including assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (Ref 15-8)	
This document aims to support best practice and decision-making for managing aspects of the historic environment.	Information relevant to the guidance note is provided including assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Our Seas – A shared resource: High level marine objectives (Ref 15-3)	
A set of objectives agreed by the UK Government, Northern Ireland Executive and Welsh Assembly Government in order to achieve desirable outcomes for the UK marine area as a whole.	Information relevant to the guidance note is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (Ref 15-9)	
This document provides guidance for good practice in environmental archaeology, and advice on the applications and methods of environmental archaeology within archaeological projects.	Information relevant to the guidance note is provided including assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Ships and Boats: Prehistory to Present: Designation Selection Guide (Ref 15-10)	
This guide outlines the selection criteria used when designating ships and boats that are part of the archaeological resource.	Assessment undertaken following guidance note (**Section 15.3** and **Section 15.4**).
Standard and Guidance for Historic Environment Desk-based Assessment (Ref 15-2)	
This guidance seeks to define good practice for the execution and reporting of desk-based assessment, in line with the by-laws of the Chartered Institute for Archaeologists. The standard and guidance was formally adopted as	Assessment undertaken following guidance note (**Section 15.3** and **Section 15.4**).

Legislation/Policy/Guidance	Consideration within the Environmental Statement
approved practice at the Annual General Meeting of the Institute held on 14 October 1994. This revision recognises the new Chartered status of the Institute.	
Marine Geophysics Data Acquisition, Processing and Interpretation Guidance Notes (Ref 15-11)	
These notes were prepared as part of the Aggregates Levy Sustainability Fund's ("ALSF") dissemination of heritage information, based on the assessment of a number of ALSF projects. It provides basic information for the characterisation of wreck sites and submerged prehistoric landscapes.	Information relevant to the guidance note is provided including design, mitigation and enhancement measures (**Section 15.7**).
Dredging and Port Construction: Interaction with Features of Archaeological or Heritage Interest (Ref 15-19)	
This guidance document is intended to promote the development of good practice for dredging and port construction in relation to underwater cultural heritage.	Information relevant to the guidance note is provided including assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).
Geoarchaeology: Using Earth Sciences to Understand the Archaeological Record (Ref 15-12)	
This guidance covers the use of geoarchaeology in understanding the archaeological record.	Information relevant to the guidance note is provided including design, mitigation and enhancement measures (**Section 15.7**).
The Assessment and Management of Marine Archaeology in Port and Harbour Development (Ref 15-13)	
This guidance provides practical advice on assessing the impact of port and harbourdevelopment in England upon the intertidal and marine historic environment. It is relevant to port and harbour owners, operators, developers and contractors, regulatory authorities, curators, archaeological consultants/contractors and other stakeholders. The document aims particularly at providing advice for environmental assessments required for new development projects, it does not address routine port operations or activities covered under existing Harbour Orders.	Information relevant to the guidance note is provided including enhanced baseline assessment of the marine historic environment (**Section 15.4**) and assessment of potential impacts (**Section 15.8**) and mitigation (**Section 15.7**).

15.4 Assessment Methodology

15.4.1 The Environmental Impact Assessment ("EIA") has followed the methodology set out in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

15.4.2 The importance of marine cultural heritage receptors has been established using criteria based on Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (Ref 15-8) and Ships and Boats: Prehistory to Present: Designation Selection Guide (Ref 15-10).

Data and Information Sources

15.4.3 Current baseline conditions have been determined by a desk-based review of available information.

15.4.4 The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the Project include:

a. United Kingdom Hydrographic Office ("UKHO") wreck database.

b. Historic England's National Record of the Historic Environment ("NRHE").

c. North East Lincolnshire Council ("NELC") Historic Environment Records ("HER").

d. Various online resources including the British Geological Survey ("BGS") Geology of Britain Viewer.

e. Historic Seascape Characterisation ("HSC") using the consolidated HSC national database (Ref 15-16).

f. Historical maps and Ordnance Survey maps.

g. Relevant primary and secondary sources in Wessex Archaeology's own library and those available through the Archaeology Data Service and other websites. Both published and unpublished archaeological reports relating to excavations and observations in the area around the study area were reviewed.

15.4.5 The baseline relating to both seabed prehistory and seabed features such as maritime and aviation receptors, has been developed through archaeological analysis of geophysical datasets.

15.4.6 An intertidal walkover survey was attempted at low tide on 25 October 2022, but unsafe ground conditions prevented access. Alternative approaches have therefore been used to inform the ES baseline, consisting of an aerial photography assessment.

15.4.7 An aerial photography assessment was undertaken in June 2023. This assessed records, consisting of aerial photographs, held by Historic England. A search request was submitted to the Historic England archives (ref: AP/139117) for all aerial photographs held which covered any part of the 500m Study Area, submitted as a shape file. The search returned a total of 110 vertical photographs, 17 oblique photos and 19 military oblique photographs.

15.4.8 The physical photographs and the digital copies were visually assessed, in conjunction with the marine gazetteer in order to identify any potential unidentified heritage assets in the intertidal zone and to further quantify the presence of any known assets.

Geophysical assessment methodology

15.4.9 A full methodology for the geophysical data assessment is provided in **Appendix 15.A [TR030008/APP/6.4]**.

15.4.10 The baseline relating to both seabed prehistory and seabed features such as maritime and aviation receptors, has been developed through archaeological analysis of geophysical survey data comprising sub-bottom profiler ("SBP"), sidescan sonar ("SSS"), magnetometer ("Mag.") and multibeam echosounder ("MBES") data sets.

15.4.11 In summary, geophysical datasets consulted during this assessment include:

a. Geophysical survey datasets and survey report produced by ABPmer (Ref 15-1) (**Appendix 15.B [TR030008/APP/6.4]**); and

b. Relevant background mapping from the area (BGS 1989, admiralty charts received from UKHO).

15.4.12 All available geophysical datasets were conducted independently of one another. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different datasets and potentially overstating the number of archaeological features in the exploration area.

15.4.13 To address this, the anomalies were grouped together; allowing one ID number to be assigned to a single object for which there may be, for example, a UKHO record, a MBES anomaly and multiple SSS anomalies (ID numbers beginning with 7, **Figures 15.4 – 15.5 [TR030008/APP/6.3]**).

15.4.14 Once all the geophysical anomalies and desk-based information were grouped, they were classified based on their archaeological potential. For anomalies located on the seabed, these are classified and discriminated as per the criteria in **Table 15-3**. The discrimination codes are included in the legends of **Figures 15.2 – 15.5 [TR030008/APP/6.3]**.

Table 15-3: Criteria discriminating relevance of identified features to The Project

Overview classification	Discrimination	Criteria
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material
Archaeological	P2	Feature of possible archaeological interest
Archaeological	A2_h	Anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature

Overview classification	Discrimination	Criteria
Archaeological	A2_I	Anomaly of likely anthropogenic origin but interpretation if uncertain; may be of archaeological interest or a natural feature
Archaeological	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly

15.4.15 The geophysical data were assessed to identify anomalies of archaeological potential relating to maritime and aviation activity. Due to the proximity of the area to the modern port workings, many of the receptors identified are likely to represent modern features and as such would not be of interest from an archaeological perspective (**Figure 15.4 [TR030008/APP/6.3]**).

15.4.16 A number of records from the UKHO, NRHE and HER sources are located outside the area of geophysical survey but within the wider Study Area of the Baseline Technical Report (**Appendix 15.A [TR030008/APP/6.4]**), both are retained in the baseline (ID numbers beginning with 2, **Figure 15.4 [TR030008/APP/6.3]**).

Determining Significance of Effects

Receptor Sensitivity

15.4.17 In order to assess the potential impacts of a development upon marine cultural heritage, the conceptual approach known as the 'source-pathway-receptor' model is adopted. This approach is based on the identification of the source (i.e. the origin of a potential impact), the pathway (i.e. the means by which the effect of the activity could impact a receptor) and the receptor that may be impacted (e.g. known/potential heritage receptors). For the significance of any given impact to be fully understood and for appropriate mitigation to be proposed, the sensitivity of any marine cultural heritage receptors that may be impacted need to be considered. This section outlines how the sensitivity of marine cultural heritage receptors is ascertained.

15.4.18 The capability of a receptor to accommodate change and its ability to recover if affected is a function of its sensitivity. Receptor sensitivity is typically assessed via the following factors:

a. Adaptability - the degree to which a receptor can avoid or adapt to an effect.

b. Tolerance - the ability of a receptor to accommodate temporary or permanent change without significant adverse impact.

c. Recoverability - the temporal scale over and extent to which a receptor will recover following an effect.

d. Value - a measure of the receptor's importance, rarity and worth.

15.4.19 Archaeological and cultural heritage receptors cannot typically adapt, tolerate or recover from physical impacts resulting in material damage or loss caused by development. Consequently, the sensitivity of each receptor is predominantly quantified only by its value. In cases where site-specific baseline data is not available, a precautionary approach is typically adopted, and potential receptors are considered high sensitivity

Value of a Receptor

15.4.20 Based on Historic England's Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (Ref 15-8), the significance of a historic receptor *"embraces all the diverse cultural and natural heritage values that people associate with it, or which prompt them to respond to it."*

15.4.21 Within this chapter, value is weighed by consideration of the potential for the receptor to demonstrate the following value criteria:

a. Evidential value – deriving from the potential of a place to yield evidence about past human activity.

b. Historical value – deriving from the ways in which past people, events and aspects of life can be connected through a place to the present. It tends to be illustrative or associative.

c. Aesthetic value – deriving from the ways in which people draw sensory and intellectual stimulation from a place.

d. Communal value – deriving from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical (particularly associative) and aesthetic values but tend to have additional and specific aspects.

15.4.22 With regards to assessing the value of shipwrecks, the following criteria listed in English Heritage's Ships and Boats: Prehistory to Present – Designation Selection Guide (Ref 15-10) can be used to assess a receptor in terms of its value:

a. Period

b. Rarity

c. Documentation

d. Group value

e. Survival/condition

f. Potential

15.4.23 These aspects help to characterise each receptor whilst also comparing them to other similar receptors. The criteria also enable the potential to contribute to knowledge, understanding and outreach to be assessed.

15.4.24 The value of known archaeological and cultural heritage receptors were assessed on a four-point scale using professional judgement informed by criteria provided in **Table 15-4** below.

Table 15-4: Criteria to assess the archaeological value of marine receptors

Value	Definition
High	Best known, only example or above average example and/or significant or high potential to contribute to knowledge and understanding and/or outreach. Receptors with a demonstrable international or national dimension to their importance are likely to fall within this category; • Wrecked ships and aircraft that are protected under the Protection of Wrecks Act 1973, Ancient Monuments and Archaeological Areas Act 1979 or Protection of Military Remains Act 1986 with an international dimension to their importance, plus as-yet undesignated sites that are demonstrably of equivalent archaeological value; and • Known submerged prehistoric sites and landscapes with the confirmed presence of largely in situ artefactual material or palaeogeographic features with demonstrable potential to include artefactual and/or palaeoenvironmental material, possibly as part of a prehistoric site or landscape.
Medium	Average example and/or moderate potential to contribute to knowledge and understanding and/or outreach; • Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have moderate potential based on a formal assessment of their importance in terms of build, use, loss, survival and investigation; and, • Prehistoric deposits with moderate potential to contribute to an understanding of the palaeoenvironment.
Low	Below average example and/or low potential to contribute to knowledge and understanding and/or outreach; • Includes wrecks of ships and aircraft that do not have statutory protection or equivalent significance, but have low potential based on a formal assessment of their importance in terms of build, use, loss, survival and investigation; and, • Prehistoric deposits with low potential to contribute to an understanding of the palaeoenvironment.
Negligible	Poor example and/or little or no potential to contribute to knowledge and understanding and/or outreach. Receptor with little or no surviving archaeological interest.

Impact Magnitude

15.4.25 The magnitude of an impact is defined by a series of factors including the spatial extent of any interaction, the likelihood, duration, frequency and reversibility of a potential impact. The definitions of the levels of magnitude used in this assessment are described in **Table 15-5**.

Table 15-5: Classification of magnitude of impact

Magnitude	Definition
High	Complete or comprehensive physical damage or changes to the character of the receptor
Medium	Considerable changes that affect the character of the receptor, resulting in considerable physical damage
Low	Minor change that partially affects the character of the receptor, resulting in some physical damage
Negligible	Very minor or negligible change to the character of the receptor, with no or negligible physical damage leading to an imperceptible change to the baseline

Significance Criteria

15.4.26 The significance of effect will be assessed by comparing the value of the receptor against the magnitude of impact. Residual effects (i.e. those remaining after mitigation measures) have been taken into consideration and have been assessed. The overall significance will be assessed using the significance matrix shown in **Table 15-6**. Any effect that is Minor to Moderate, Minor or Negligible is not considered significant in this assessment.

Table 15-6: Significance matrix

		Value			
		High	**Medium**	**Low**	**Negligible**
Magnitude/Scale of Change	**High**	Major	Major to Moderate	Moderate	Negligible
	Medium	Major to Moderate	Moderate	Minor to Moderate	Negligible
	Low	Moderate	Minor to Moderate	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Limitations and Assumptions

15.4.27 The information presented in this assessment reflects the proposed parameters and design for the Project as described in **Chapter 2: The Project [TR030008/APP/6.2]**.

15.4.28 The geophysical data were assessed to identify features of archaeological potential relating to maritime and aviation activity. Due to the proximity of the area to the active, modern port workings, many of the objects identified may represent modern features and as such would not be of interest from an archaeological perspective. However, this cannot be confirmed without visual inspection; as such, they have been retained as a precautionary measure.

15.4.29 The assessment has been undertaken based on the following assumptions:

a. Data used to compile this report consists of secondary information derived from a variety of sources. The assumption is made that the secondary data, as well as that derived from other secondary sources, are reasonably accurate.

b. The records held by the UKHO, NRHE, local HERs and the other sources used in this assessment are not a record of all surviving cultural heritage receptors, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these sources does not inhibit the subsequent discovery of historic environment receptors that are, at present, unknown.

15.5 Study Area

15.5.1 The study area is the area over which potential direct and indirect effects of the Project that may occur during construction and operation. Direct effects on marine cultural heritage receptors are confined to within the footprint of the Project i.e. the construction works and dredging (e.g. **Figure 15.1 [TR030008/APP/6.3]**). Indirect effects are those that may arise due to wider changes in the estuary flow and sedimentary regime and any change to the estuary morphology as a result of the Project.

15.5.2 The study area for the marine archaeology topic comprises the footprint of the marine works associated with the Project and a 500m buffer zone. This has been used to capture relevant data on designated and non-designated marine archaeological receptors that may be impacted by the Project, and to provide the necessary context for understanding archaeological potential and heritage significance of the relevant receptors.

15.5.3 Within this general study area, a geophysical study area comprised the footprint of the marine works associated with the Project and a 100m buffer zone. In this area geophysical data were assessed to better understand the geological context of the Site and also to allow for any features which may require an archaeological exclusion zone (“AEZ”) to be identified with the 100m buffer.

15.6 Baseline Conditions

Current Baseline

15.6.1 This section describes the baseline environmental characteristics within the study area with specific reference to marine cultural heritage and marine archaeology.

Marine Cultural Heritage Receptors

15.6.2 Marine cultural heritage receptors located within the study area can be characterised as comprising four fundamental categories:

a. Seabed prehistory.

b. Maritime archaeology.

c. Aviation archaeology.

d. Intertidal heritage receptors.

Seabed Prehistory

15.6.3 The underlying solid geology is Upper Cretaceous Chalk. Locally there are two formations: Flamborough Chalk and Burnham Chalk. The younger Flamborough Chalk has identifiable bedding surfaces, distinct marl bands and is without flint. The underlying Burnham Chalk, along the eastern part of the Site, is thinly bedded and laminated and contains continuous flint bands. The Port of Immingham is located at a point where the Burnham Chalk Formation is not covered by the Flamborough Chalk Formation.

15.6.4 The chalk surface is characterised by a highly fractured zone created by glacial and periglacial processes and overlain by Pleistocene deposits of Glacial Till. These glacial and post-glacial sequences are subsequently overlain by fine-grained (Clay and Silt) Tidal Flat Deposits.

15.6.5 Beyond areas of industrial development, the area comprises Holocene peats, estuarine alluvium, and tidal flat deposits of sands, silts, and clays.

15.6.6 Assessment of the geophysical data within the study area resulted in a total of four features of palaeogeographic interest (shown on **Figure 15.2 [TR030008/APP/6.3]**). These are summarised as follows:

a. A total of one channel (**7502**) and 2 possible peat outcrops (**7501** and **7503**) were assigned a P1 archaeological rating; and

b. One channel (**7500**) has been assigned a P2 archaeological rating.

15.6.7 As terrestrial features interpreted as being deposited during periods of likely human occupation, those features given a P1 archaeological rating are considered of high archaeological potential. The feature with a P2 discrimination is considered of medium archaeological potential due to the uncertainty of whether any fill of paleoenvironmental or archaeological interest remains.

15.6.8 The results of the onshore geological work presented in **Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2]** found no clear evidence for the suspected palaeochannel identified in this assessment. However, evidence for peat deposits scattered throughout the area of survey was found, comparable to this assessment, indicating that at one time marsh land extended out beyond the current coastline.

Maritime, Aviation and Intertidal Archaeology

15.6.9 The marine archaeological and cultural heritage receptors listed in the NRHE, the UKHO wreck database and the NELC HER that are located within the study area are listed in **Table 15-7** and shown on **Figure 15.4 [TR030008/APP/6.3]**. The section below presents a summary of the baseline.

Table 15-7: Known Marine Cultural Heritage Receptors

WA ID	External References	Type	Description	Easting	Northing
2001	UKHO 65126	Obstruction	Octagonal obstruction shown on aerial photography	520765	415966
2002	UKHO 65127	Obstruction	Octagonal obstruction shown on aerial photography	520788	416015
2003	UKHO 8576; HER MNL1473; NRHE 908340	Wreck	Possible remains of craft recorded between 1991 and 1999. No details are known, and it was listed as dead in 2004	520808	415999
2004	UKHO 65124	Obstruction	Rectangular obstruction shown on aerial photography	520823	415903
2005	UKHO 65128	Obstruction	Octagonal obstruction shown on aerial photography	520826	415994
2006	UKHO 73629	Wreck	Shown on Humber 8, April 2009 Edition.	520832	416009
2007	UKHO 65125	Obstruction	Cigar shaped obstruction shown on aerial photography	520833	415905
2008	UKHO 8507; HER MNL1476; NRHE 907859	Wreck	The HVITVEIS. A Norwegian schooner, built in 1915, which foundered following a collision with the Danish registered SS *Ulla* en route from Goole to Rouen with a cargo of coal.	522073	416696

WA ID	External References	Type	Description	Easting	Northing
2009	HER MNL4434	Anti-submarine defence	Site of World War 1 anti-submarine defences, off Stallingborough Haven. This is the westernmost of three in the Humber, known as the 'Inner Boom'. This consisted of a line of dolphins and nets in the water.	Polygon	
WA = Wessex Archaeology					

15.6.10 Maritime archaeological sites can be considered to comprise two broad categories;

a. The remains of vessels that have been lost as a result of stranding, foundering, collision, enemy action and other causes.

b. Sites that consist of vessel-related material.

15.6.11 Vessel-related material includes (but is not limited to) equipment lost overboard or deliberately jettisoned, such as fishing gear, ammunition and anchors or the only surviving remains of a vessel such as its cargo or a ballast mound. Shipwrecks on the seabed provide an insight on the types of vessels used in the past, the nature of shipping activity in the wider area and the changing usage of the marine environment through different periods. Such remains are considered more likely in sediments which promote the preservation of wreck sites (e.g. finer grained sediments that are not subject to high levels of mobility), particularly where such sediments have seen limited, recent disturbance.

15.6.12 There are no sites within the study area that are subject to statutory protection from the Protection of Wrecks Act 1973, the Protection of Military Remains Act 1986 or the Ancient Monuments and Archaeological Areas Act 1979; the three principal statutes that could be used to protect marine archaeological sites.

15.6.13 There are three records of wrecks in the defined study area. Records **2006** and **2008** are wrecks still considered to be located on the seabed. Record **2008** is the wreck of the Norwegian schooner *Hvitveis* that was built and sank in 1915. Record **2006** is unknown. Records **2003** was an unknown wreck that was listed as dead in 2004 i.e. it has not been detected by repeated surveys, although wreck material may still exist at this location. Finally, records **2003** and **2006** may be located in the intertidal zone.

15.6.14 There is the potential for further unknown wreck material to exist. However, the Port of Immingham was constructed in the early 20th century. This suggests that there is lower potential for pre-20th century wreck material to survive within the Project area, both due to a relatively smaller level of maritime activity prior to the construction of the Port and due to the extensive dredging, that has taken place on the adjacent seabed both during construction and since.

15.6.15 A total of 162 features have been identified from the archaeological assessment of geophysical data as being of possible archaeological potential within the study area, defined as follows:

a. 74 A2_h anomalies (anomaly of likely anthropogenic origin but of unknown date; may be of archaeological interest or a modern feature).

b. 88 A2_I anomalies (anomaly of possible anthropogenic origin but interpretation is uncertain; may be anthropogenic or a natural feature).

15.6.16 No A1 or A3 anomalies have been identified from the archaeological assessment.

15.6.17 These features include anomalies from magnetometer, multi-beam echo sounder and sidescan sonar data, or a combination of the three. Full details can be found in **Section 3** of **Appendix 15.A [TR030008/APP/6.4]** to this ES and illustrated in **Figure 15.4 [TR030008/APP/6.3]** and **Figure 15.5 [TR030008/APP/6.3]** to this ES.

15.6.18 Intertidal features located below MHWS and above mean low water springs ("MLWS") comprise 'obstructions' and dolphins and large debris from 20th century port activity (**2001**, **2002**, **2004**, **2005** and **2007**) (**Figure 15.4 [TR030008/APP/6.3]**).

15.6.19 The NELC HER lists the site of a First World War anti-submarine boom (**2009**). This is the westernmost of three such defences in the Humber and was known as the 'Inner Boom'. It consisted of a line of dolphins and nets in the water.

15.6.20 The Aerial photography assessment did not identify any new or potential heritage assets in the intertidal zone. The majority of the aerial photographs were taken at high tide, or concentrated primarily on the terrestrial port, making identification of further assets difficult.

15.6.21 Marine aviation archaeology receptors comprise the remains or associated remains of military and civilian aircraft that have been lost at sea. Evidence is divided into three primary time periods based on major technological advances in aircraft design, namely: pre-1939; 1939-1945; and post-1945. Although there are currently no known aircraft crash sites located within the study area, there is the potential for the discovery of previously unknown aircraft material. This is highlighted by the recorded loss of a Halifax MK III, that ditched off Immingham in October 1944. There is particularly high potential for the discovery of aircraft from 1939-1945. There were numerous airfields and local anti-aircraft installations in the vicinity of the Project during the Second World War, with Royal Air Force (RAF) Goxhill and RAF North Killingholme being particularly proximate. Further, the RAF Air Sea Rescue Services are known to have attempted numerous rescues of aircrew from crashed aircraft in the Humber Estuary during the Second World War (Ref 15-20). The remains of crashed military aircraft are protected under the Protection of Military Remains Act 1986 and cannot be disturbed without a licence.

Future Baseline

15.6.22 In the absence of the Project there would be no change to known and potential archaeological marine cultural heritage receptors beyond those caused by natural physical processes and natural deterioration. Physical effects to marine receptors are considered below in terms of likely impacts and effects.

15.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

15.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to marine cultural heritage through the process of design development, and by embedding mitigation measures into the design.

15.7.2 This consisted of the development of design iterations towards fewer berths, leading to reduced overall area where direct physical impacts to marine cultural archaeology and cultural heritage receptors may develop.

Standard Mitigation Measures

15.7.3 The following mitigation measures, set out within an Outline Written Scheme of Investigation (see **Appendix 15.B [TR030008/APP/6.4]**) have been considered as part of the design development of the Project:

a. Avoidance of known marine cultural heritage receptors (e.g. AEZs).

b. Geoarchaeological and geophysical data assessment for baseline enhancement.

c. Protocol for Archaeological Discoveries.

Archaeological Exclusion Zones

15.7.4 The primary mitigation for the protection of known archaeological receptors is avoidance. This is commonly achieved through the implementation and monitoring of AEZs, which are proposed for identified high value seabed receptors of anthropogenic origin (i.e. A1 classified geophysical anomalies).

15.7.5 The Assessment and Management of Marine Archaeology in Port and Harbour Development (Ref 15-13) states that AEZs are formed by establishing a buffer around the known extents of sites for which the available evidence suggest that there could be archaeological material present on the seabed. The mitigation will establish appropriately sized AEZs around receptors which have been considered to be of high archaeological potential, in consultation with the Archaeological Curators (Historic England). These areas would be out of bounds to construction activities and to anchoring. Monitoring of any AEZs to ensure there is no disturbance to them would be part of this mitigation.

Geoarchaeological and geophysical data assessment for baseline enhancement

15.7.6 Geophysical surveys undertaken to support the project design, would also be assessed by a suitably qualified archaeological contractor to support baseline enhancement and identification of unknown marine cultural heritage receptors.

15.7.7 Similarly, the geoarchaeological assessment of any future marine borehole logs obtained as part of this detailed design ground investigation would also be undertaken to enhance the baseline understanding of submerged palaeolandscapes, particularly in relation to the four identified P1 and P2 receptors.

Protocol for Archaeological Discoveries ("PAD")

15.7.8 If previously unknown sites or material are encountered during the different phases of the Project, measures would be taken to reduce the level of impact. In order to provide for these unexpected discoveries a PAD would be adopted. A PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during construction activities, with a Retained Archaeologist providing guidance and advising on the implementation of the PAD.

15.7.9 The PAD also makes provision for the implementation of temporary exclusion zones around areas of possible archaeological interest, for prompt archaeological advice, and, if necessary, for archaeological inspection of important features prior to further activities in the vicinity. The PAD provides a mechanism to comply with the Merchant Shipping Act 1995, including notification of the Receiver of Wreck, and accords with the Code of Practice for Seabed Developers (Ref 15-15) and The Assessment and Management of Marine Archaeology in Port and Harbour Development (Ref 15-13).

15.8 Assessment of Likely Impacts and Effects

15.8.1 This section identifies the potential likely effects on the marine cultural heritage receptors as a result of the construction and subsequent operation of the Project which have been identified.

15.8.2 These impacts are associated with:

a. Construction of jetty infrastructure.

b. Capital dredging.

15.8.3 The Physical Processes assessment (**Chapter 16: Physical Processes [TR030008/APP/6.2]**) was consulted to assess the damage to known and unknown receptors from indirect impacts.

15.8.4 Cumulative impacts on marine cultural heritage receptors that could arise as a result of other developments and activities in the Humber Estuary have been considered as necessary as part of the cumulative impacts and in-combination effects assessment (see **Chapter 25: Cumulative Effects and In-Combination Assessment [TR030008/APP/6.2]**).

Construction

15.8.5 This section contains an assessment of the potential impacts to marine archaeology and cultural heritage receptors as a result of the construction phase of the Project (see **Chapter 2: The Project [TR030008/APP/6.2]**). The assessment of impacts on the historic marine environment considers the entire extent of the Project and is considered a 'worst-case' scenario in terms of potential impacts.

15.8.6 The following impact pathways have been assessed:

a. Direct impacts on known and potential marine cultural heritage receptors as a result of construction and capital dredging.

b. Indirect impacts to known and potential marine cultural heritage receptors due to altered sediment or hydrological processes.

15.8.7 Any direct impacts to marine cultural heritage receptors are likely to occur during capital dredging activities at the berth and marine piling (see **Chapter 2: The Project [TR030008/APP/6.2]**). Impacts resulting in negative effects upon marine archaeology and cultural heritage receptors as part of dredging or marine piling works (for example) are those involving contact with the seabed and/or the removal of seabed sediments.

15.8.8 Nine A2_h anomalies intersect with the Approach Trestle piling design (7017, 7031, 7034, 7050, 7051, 7053, 7072, 7100, 7115), a further A2_h anomaly (7144) is located between the Jetty Head and Dolphins and should be considered for precautionary inspection if likely to be close to construction activities (**Figure 15.4 [TR030008/APP/6.3]**).

15.8.9 Two palaeogeographic features of archaeological interest are recorded intersecting with the Approach Trestle (7500, 7501) (**Figure 15.2 [TR030008/APP/6.3]**).

15.8.10 There are examples of A2_l anomalies within or close to the proposed dredge pocket and pocket side (7143, 7145, 7141). They represent buried, small magnetic anomalies and may have archaeological potential (**Figure 15.4 [TR030008/APP/6.3]**).

15.8.11 Any adverse effects, i.e. physical damage, upon marine cultural heritage receptors from direct impacts associated with dredging and marine piling would be permanent and irreversible. As such, the magnitude of direct impacts on known and potential marine cultural heritage receptors, and potential seabed prehistory features as part of construction and capital dredging activities, if they were to occur, would be high.

15.8.12 As a result, if appropriate mitigation is not applied, both the high sensitivity (see **Paragraph 15.4.19**) and the high magnitude of impact on such resources would result in a **major adverse** significant effect. This is considered to be **significant** in EIA terms.

15.8.13 The assessment of changes to hydrodynamics and sedimentary processes predicts a **low/negligible** exposure to change (**Chapter 16: Physical Processes [TR030008/APP/6.2]**), the magnitude of indirect impacts to marine cultural heritage receptors during the construction phase is expected to be negligible. Similarly, impacts from construction vessel movements are considered to be localised and temporary, and the magnitude of change is assessed as negligible.

15.8.14 Therefore, the high sensitivity of potential receptors and negligible magnitude of indirect impacts on such resources will result in **negligible** effects, considered **not significant**.

Operation

15.8.15 This section contains an assessment of the potential impacts to marine cultural heritage receptors as a result of the operational phase of the Project. The following impact pathways have been identified:

a. Direct impacts on known and potential marine cultural heritage receptors and deposits of archaeological importance as a result of operational activities and maintenance dredging.

b. Indirect impacts to known and potential marine cultural heritage receptors due to altered sediment or hydrological processes.

15.8.16 As maintenance dredging, if required, will take place in areas where the impact has already occurred for the capital dredge during the construction phase, there is unlikely to be further impact. Therefore, the magnitude of direct impacts on such resource would result in **negligible** effects, considered **not significant**.

15.8.17 As a result of the assessment of changes to hydrodynamics and sedimentary processes which predicts a **low/negligible** exposure to change (**Chapter 16: Physical Processes [TR030008/APP/6.2]**), the magnitude of indirect impacts to marine cultural heritage receptors during the operation phase is expected to be negligible. Similarly, impacts from construction vessel movements are considered to be localised and temporary, and the magnitude of change is assessed as negligible.

15.8.18 Therefore, the high sensitivity of potential receptors and negligible magnitude of indirect impacts on such resources will result in **negligible** effects, considered **not significant**.

Decommissioning

15.8.19 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on the marine historic environment have been scoped out of the EIA.

15.9 Mitigation and Enhancement Measures

15.9.1 Mitigation measures are described within a WSI and will be secured within the Deemed Marine Licence which forms Schedule 3 of the **draft DCO [TR030008/APP/2.1]**. An Outline WSI is included as **Appendix 15.B [TR030008/APP/6.4]** to this ES. The final WSI will need to take account of any relevant matters emerging through the ongoing detailed design process and any relevant matters emerging through the examination of the DCO application.

15.9.2 The following measures – which will be included in the WSI - are designed to mitigate any predicted adverse effects upon seabed receptors from direct impacts. The mitigation measures are designed to either avoid, reduce or offset any damage/disturbance occurring as a result of the Project upon known receptors, and to establish the presence of unknown sites.

AEZs

15.9.3 As no A1 anomalies have been identified for this assessment, no AEZs are currently recommended for the Project. Any A1 anomalies discovered during the works (e.g. through the PAD - see **Paragraph 15.7.8** of this chapter) then this mitigation will be used.

A2 anomalies

15.9.4 For anomalies assigned an A2 archaeological classification, especially A2_h anomalies (**Appendix 15.A [TR030008/APP/6.4]**), no AEZs are currently recommended. However, avoidance of these anomalies by micro-siting will be carried out, if possible, if they are directly impacted by the Project. If micro-siting is not possible, then further appraisal and investigation to ascertain the nature of the anomalies would take place.

15.9.5 Further investigations would mean that anomalies can either have their archaeological value removed, if they prove to be natural features or modern, or their value as archaeological receptors confirmed. If their value is confirmed, mitigation in the form of either avoidance (which may be enacted by the implementation of an AEZ) or through remedying or offsetting measures as identified through a PAD (see **Paragraph 15.9.4** of this chapter).

15.9.6 The agreed WSI will detail the agreed mitigation that will be in place during the construction of the Project. The implementation of a WSI is the mitigation, rather than the document itself. The WSI has been and will continue to be developed in line with Historic Environment guidance for Port and Harbour development (Ref 15-13). The WSI is based on the measures recommended in this chapter and will be subject to approval by the Archaeological Curator (Historic England) through the application examination process.

15.9.7 In cases where avoidance is either inappropriate or impossible, the damage to archaeological receptors would be offset, generally by more extensive study, excavation or survey of the receptor. Any mitigation strategy will be identified within the WSI and any recommended methods will be covered by a specific Method Statement, approved by the Archaeological Curator (Historic England), should they be implemented.

15.9.8 Where suitable for archaeological assessment, further geophysical surveys undertaken in advance of the development commencing, for example for the purposes of detailed design, that require magnetometer data (e.g., unexploded ordnance ("UXO") survey) will also be assessed by a suitably qualified archaeological contractor. This will allow for the identification of any additional ferrous features of archaeological potential within the Project, as well as to confirm the presence of ferrous material at the location of features identified during this assessment.

Palaeogeography

15.9.9 The appraisal of geophysical data resulted in the identification of a total of four features of palaeogeographic interest within the study area, intersecting with the proposed open-piled approach trestle. Mitigation measures to offset physical effects to palaeogeographic receptors are discussed below. These features are summarised as follows:

a. One channel (7502) and two possible peat outcrops (7501 and 7503) were assigned a P1 archaeological rating.

b. One channel (7500) has been assigned a P2 archaeological rating.

15.9.10 As terrestrial features interpreted as being deposited during periods of likely human occupation, those features given a P1 archaeological classification are considered of high archaeological potential. Those features with a P2 classification are considered of medium archaeological potential.

15.9.11 For the purposes of the detailed design of the marine elements of the project, further ground investigation work is programmed to take place. Appropriate archaeological advice has been provided on how that investigation can provide samples of benefit to ongoing archaeological considerations in synergy with the Outline WSI (**Appendix 15.B [TR030008/APP/6.4]**).

15.9.12 A geoarchaeological assessment of any future marine borehole logs obtained as part of this detailed design ground investigation will be undertaken, especially in respect of any logs that contain organic deposits for dating purposes. This will aid in refining the interpretation and therefore help determine the archaeological potential of the area.

PAD

15.9.13 As discussed in **Paragraphs 15.7.8** and **15.7.9**, if previously unknown sites or material are encountered during the different phases of the Project, a PAD will be adopted to reduce the level of impact on unexpected discoveries. The PAD is a system for reporting and investigating unexpected archaeological discoveries encountered during construction activities, with a Retained Archaeologist providing guidance and advising on the implementation of the PAD.

15.10 Assessment of Residual Effects

Construction

15.10.1 The assessment considered two impact pathways from the construction phase in detail. These addressed the potential for direct and indirect impacts on known and potential heritage receptors from construction activities and from capital dredging.

15.10.2 No AEZs are currently recommended for the Project. With regards potential maritime and aviation receptors (e.g. A2_h anomalies), avoidance through micro-siting, where possible, is typically proposed. Where this is not possible additional measures to establish the nature of potentially impacted anomalies is recommended.

15.10.3 With the adoption of the appropriate mitigation (**Table 15-8**) any effects resulting from the Project would be **negligible** and considered **not significant**. Therefore, no further mitigation is required.

15.10.4 Should seabed prehistory receptors be confirmed at the Site, a **positive** effect could be achieved through contributing to the knowledge base of seabed prehistory receptors, for example through geophysical and geoarchaeological assessment.

Operation

15.10.5 The assessment considered two impact pathways from the operation phase in detail. These addressed the potential for direct and indirect impacts on known and potential heritage receptors from maintenance dredging and operational activities.

15.10.6 Any maintenance dredging works to be carried out during the operational phase (if required) will have a relatively small and defined footprint, and significant impacts would have already likely occurred during the construction phase. With the implementation of the appropriate mitigation measures set out above the significance of any direct or indirect effects on marine archaeology will be **negligible** and considered **not significant**. Therefore, no further mitigation measures are required.

Decommissioning

15.10.7 As set out in **Paragraph 15.8.19**, the DCO would not make any provision for the decommissioning of the marine infrastructure above and below water level. No impacts were therefore considered for the decommissioning phase.

15.11 Summary of Assessment

15.11.1 A summary of the impact pathways that have been assessed, the identified residual effects and level of confidence is presented in **Table 15-8** of this Chapter.

Table 15-8: Summary of potential impact, mitigation measures and residual effects

Receptor	Impact Pathway	Pre-mitigation Impact Significance	Mitigation Measure	Residual Effects	Confidence
Construction Phase					
Known marine cultural heritage receptors	Direct impacts on known and potential marine cultural heritage receptors and deposits of archaeological importance as a result of construction and capital dredging	**Major adverse**	Geophysical and geoarchaeological assessment of project survey data. Then, avoidance of known and potential receptors, implementation of AEZs where deemed appropriate and reduction via a PAD and specific measures agreed within a WSI for A2 anomalies within the construction footprint.	**Negligible positive (as long as geotechnical data are retained, analysed, and reported on by qualified geoarchaeologist)**	High
Potential marine cultural heritage receptors					
Known marine cultural heritage receptors	Indirect impacts to known and potential marine cultural heritage receptors due to altered sediment or hydrological processes.	**Negligible**	-	**Negligible**	High
Potential marine cultural heritage receptors		**Negligible**	-	**Negligible**	High

Receptor	Impact Pathway	Pre-mitigation Impact Significance	Mitigation Measure	Residual Effects	Confidence
Operational Phase					
Known marine cultural heritage receptors	Direct impacts on known and potential marine cultural heritage receptors from maintenance dredging	**Negligible**	-	**Negligible**	High
Potential marine cultural heritage receptors					
Known marine cultural heritage receptors	Indirect impacts to known and potential marine cultural heritage receptors due to altered sediment or hydrological processes.	**Negligible**	-	**Negligible**	High
Potential marine cultural heritage receptors		**Negligible**	-	**Negligible**	High

15.12 References

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Ref 15-22 HMSO (1973). Protection of Wrecks Act 1973.

Ref 15-23 HMSO (1979). Ancient Monuments and Archaeological Areas Act 1979.

Ref 15-24 HMSO (1986). Protection of Military Remains Act 1986.

Ref 15-25 HMSO (1995). Merchant Shipping Act 1995.

Ref 15-26 HMSO (1996). Treasure Act 1996.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 16: Physical Processes

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 16: Physical Processes

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

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16 Physical Processes

16.1 Introduction

16.1.1 This chapter presents the findings of the assessment of likely significant effects of the Project on marine Physical Processes. For more details about the Project, including construction methodology, layout and life span, refer to **Chapter 2: The Project [TR030008/APP/6.2]** of this Environmental Statement ("ES").

16.1.2 This assessment identifies the potential environmental changes likely to result from the proposed activity and the physical processes that are likely to be affected. The elements of the Project with the potential to impact physical processes of the existing system are the marine piling and marine works, capital and maintenance dredging and associated construction and operational vessel movements. The physical processes under consideration are together referred to as the impact pathways, which have the potential to affect identified receptors (within this and other topic chapters). The following impact pathways have been considered as part of the assessment:

a. Hydrodynamics
b. Sediment transport
c. Plume dispersion
d. Waves

16.1.3 Where predicted impacts to these pathways have the potential to subsequently impact specific features of interest (such as the local coastline, nearshore sandbank and channel system, existing berth and jetty infrastructure), these have been identified and considered within the assessment in **Section 16.8**.

16.1.4 There may be interrelationships related to the potential effects on Physical Processes and other disciplines and, where this is the case, the findings of the physical processes assessment have been used to inform other topic chapters. Therefore, also refer to the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 9: Nature Conservation (Marine Ecology)**
b. **Chapter 10: Ornithology**
c. **Chapter 15: Historic Environment (Marine)**
d. **Chapter 17: Marine Water and Sediment Quality**
e. **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage**
f. **Chapter 19: Climate Change**.

16.1.5 This chapter is also supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 16.1**: Regional setting within wider Humber
b. **Figure 16.2**: Bathymetric data across Project site
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n. **Figure 16.14**: Modelled difference to baseline bed level change over a mean spring neap cycle

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p. **Figure 16.16**: Modelled change in Hs for 0.5-yr wave event from southeast (top) and 50-yr wave event from northeast (bottom)

q. **Figure 16.17**: Modelled change in Hs for 50-yr wave event from east (top) and southeast (bottom)

16.1.6 A numerical model calibration report (covering each of the different modules) is provided in **Appendix 16.A [TR030008/APP/6.4]**. A geophysical survey report is provided at **Appendix 16.B [TR030008/APP/6.4]** and a hydrodynamic survey report is provided at **Appendix 16.C [TR030008/APP/6.4]**.

16.1.7 Numerical modelling tools and conceptual analyses have been used to predict coastal processes and hydrodynamic effects by comparing the baseline and future environmental conditions created by the Project. This includes predicting the changes to tidal water levels, currents, and waves. It also includes modelling of sediment transport pathways (including assessment of potential changes to erosion and accretion patterns) and the fate of sediment plumes from marine construction and maintenance dredging and disposal activities.

16.1.8 Changes in hydrodynamic (and sedimentary) processes are considered in the context of climate change (specifically sea level rise) over the engineering design period of the Project by assessing the effects under projected future sea levels. As further sampling data are acquired this information will be analysed to optimise the construction and dredging methods and minimise changes in physical processes during construction and operation. Some existing ground investigation data does exist, which has been used to inform the sediment transport and dredge plume modelling. Additionally, this data has been used to inform the specifications of the Project specific ground investigation ("GI") works.

16.1.9 Modelling has been completed using existing models of the Humber Estuary, with updates to ensure mesh resolution and model performance across the primary study area remains suitable. The modelling utilises the state of the art Mike suite of modelling software from the Danish Hydraulics Institute ("DHI"). These modelling tools have previously been developed specifically for oceanographic, coastal and estuarine applications within the Humber region. The selected modelling tools have been updated with the latest available bathymetric and topographic data and have undergone a further verification stage using local measurements collected for the Project (see **Appendix 16.A [TR030008/APP/6.4]**).

16.1.10 Following the refinement of the models to replicate the baseline conditions, the models have then been updated to include a representation of the marine elements of the Project, namely the jetty, the dredge footprint and the dredge disposal site(s). The models also include a representation of any other coastal and marine developments that may overlap or interact with the Project to allow the potential for cumulative effects to be assessed.

16.2 Consultation and Engagement

16.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the Physical Processes assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on Physical Processes. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 (**Appendix 1.B [TR030008/APP/6.4]**).

16.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

16.2.3 As a result of consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

16.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 16-1**. The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 16-1: Scoping Opinion Comments on Physical Processes

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Opinion, 10 October 2022	Planning Inspectorate	The Scoping Report refers to physical environmental receptors "such as the local coastline and the nearshore sandbank and channel system, along with existing berth and jetty infrastructure". The ES must clearly describe the receptors to be considered in the assessment and explain how/why they were identified. The ES should consider whether the changes to physical processes would impact on sea defences through changes to wave patterns or sedimentation, and the likelihood of impacts on any telemetry devices in the area of Immingham docks.	Receptor pathways have been identified as, sediment transport, plume dispersion and waves. For each of these receptor pathways, the potential impacts on the local coastline (including existing defences), nearshore sandbank and channel system, existing berth and jetty infrastructure have been assessed in **Section 16.8**.
Scoping Opinion, 10 October 2022		The Scoping Report states that for impacts on physical receptors (i.e. local coastline, sandbank and channel system, existing infrastructure) an assessment of effect significance would be undertaken following the methodology presented in section 4.6 of Chapter 4 The EIA Process. The ES should explain and justify how the evaluation of the importance/ value and sensitivity of relevant physical processes receptors has been undertaken, and how the magnitude of impact has been defined for this aspect.	The approach to the assessment for physical processes is outlined in **Section 16.4**. Where applicable, the assessment for physical processes receptors is carried out in line with the Environmental Impact Assessment ("EIA") methodology in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.
Scoping Opinion, 10 October 2022		Item J mentions relevant local policy and we would highlight the need to consider the relevant Shoreline Management Plan and Humber Estuary schemes/plans in relation to this topic.	Reference is made to local planning policy and plans including the River Basin Management Plan and Shoreline Management Plan and information has been provided as to the relevance of these plans to the Project in relation to physical processes (**Table 16-2** in **Section 16.3**).

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Opinion, 10 October 2022	Environment Agency	This Chapter sets out what will be done to assess the changes to physical processes and what these impacts will be. We are pleased that at this stage no issues have been scoped out. However, we would like the assessment to also specifically consider whether the changes to physical processes would have an impact on sea defences through changes to wave patterns or sedimentation. Paragraph 15.4.8 states that the jetty will not be decommissioned and is likely to remain part of the port estate. An engineering standard of 50 years has been given for the development. If the jetty is to remain in place longer than 50 years, the assessments need to reflect this in an appropriate design life for the marine element of the proposed development. Paragraph 15.6.9 summarises the relevant legislation, policy and technical guidance, which will be cross-referenced as appropriate. Item J mentions relevant local policy and we would highlight the need to consider the relevant Shoreline Management Plan and Humber Estuary schemes/plans in relation to this topic.	Modelling of wave patterns and sediment transport has been carried out and the assessment is presented in **Section 16.8**. The Shoreline Management Plan and other plans relevant to the Humber Estuary have been considered and are detailed in **Table 16-2**.
Statutory Consultation (PEI Report) January – February 2023	Marine Management Organisation	Section 9.7.28 indicates that the development would be a very minor intervention in the sediment cycling within the estuary volumes and Table A10 (Appendix 16A) suggests that the mud transport model reproduces the essential features of the sediment system. However, Plate A21 (Appendix 16A) shows that the suspended sediment concentrations (SSC) model yields a good overall pattern but a (very) large number of observations of SSC are well in excess of the modelled curve, i.e. the actual total suspended sediment is very often substantially underestimated by the model. The PEI Report should	Additional review and description of the model performance against the measured data has been included in the ES **Appendix 16.A [TR030008/APP/6.4]**.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		comment on how the model (under-)estimates used might (or not) have affected the impact assessment.	
Statutory Consultation (PEI Report) January – February 2023		Calibration/validation of hydrodynamics models is presented in Appendix 16A (volume IV), where it is shown that target accuracies for the current modelling are achieved, but that the wave model appears to underestimate wave heights/periods, (frequently by 50%) in a range of conditions at the calibration location. More comment should be provided on how this performance affects the results of the discrete/extreme events used to derive the results used in the PEIR. For instance, it should be explained why, as per Appendix 16A 1.5.9, "Overall, the performance of the model is considered sufficient for use in the subsequent assessment of potential impact on defined wave events". For example, can it be assumed that the modelled wave height and period at the jetty (impact) location could be <50% of the wave that could really occur in this scenario; and, would the impact of the structure be greater if the waves were actually 100% larger than the modelled case, and if so, is it possible to estimate by how much?	Model performance has been updated to include the newly collected hydrodynamic survey data, along with explanation of model performance against observed events (see **Appendix 16.A [TR030008/APP/6.4]**).
Statutory Consultation (PEI Report) January – February 2023		In section 16.6.28, it is indicated that additional SSC data will be collected. When presenting this data, focus should be on the extent and duration of natural 'excess SSC events' such as storms. Rather than absolute (discrete) values as already presented (showing excess SSC associated with dredge of up to 600-800 mg/L versus a	Additional data has been included from survey within **Appendix 16.A [TR030008/APP/6.4]**, to include focus on natural excess SSC events' in order to provide context to the predicted dredge/disposal impacts.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		typical tidal range of 100-1000 mg/L, i.e. order 100% increase) the assessment of the impacts should focus on the temporal dimension – the typical duration of natural excess vs dredge-associated excess SSC (i.e., is a dredge event unusually long and atypical of normal behaviour?)	
Statutory Consultation (PEI Report) January – February 2023		The PEIR indicates that the applied physical process mitigation (16.7.1) includes Embedded Mitigation (minimising dredge requirements by design and location of the jetty) and Standard Mitigation (disposal (if required) evenly to reduce mounds). The MMO suggests that adding beneficial reuse of dredge sediment as a possible 'net gain' mitigation for development impacts more widely should be considered.	The options for beneficial use of dredged material have been considered within **Appendix 2.A[TR030008/APP/6.4]**.
Statutory Consultation (PEI Report) January – February 2023		"The MMO consider that a small number of figures could be amended for readability: · Plate 2-1 is not marked to help locating Figures 2.1/2.2 (and Figure 2.2 is just a less detailed version of 2.1, therefore it should be considered whether both are required) and locations only become clear on Figure 3.3. · The spatial scale is not explicit on Fig 16-9 (hydrodynamic impact extents)."	Figures have been reviewed and updated (as necessary) in the ES.
Statutory Consultation (PEI Report) January – February 2023	Natural England	"Chapters 16 and 17: Physical Processes and Marine Water and Sediment Quality Based on our current understanding, Natural England broadly agrees with the scope of the assessment set out in Chapters 16 and 17 of the PEIR, however, we note that the sediment sampling and physical process modelling is	Noted. The wider Humber Estuary system (including relevant designated features) are included within the assessment in **Section 16.8**.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		currently incomplete and therefore we may provide additional comments. We note that the Humber Estuary SSSI should be included in the assessment."	
Pre-application meeting, 20 April 2023	Marine Management Organisation and Cefas	The meeting provided an update on the Project and focused on discussing comments received from the MMO and Cefas on the PEIR with respect to physical processes and water and sediment quality	The scope of the environmental assessments has been completed taking on board consultee comments from this meeting.
Second Statutory Consultation May 2023 – July 2023	Natural England	Natural England acknowledges the efforts made to reduce the project footprint, specifically the re-design of the jetty structure, which will see the number of berths decrease from two to just a single berth. Although we welcome these changes and anticipate that the downscaling of infrastructure may have a beneficial effect in terms of reducing the environmental impact on the site, Natural England would need to review the new maximum parameters for all aspects of the new design along with the activities in the construction phase, i.e., updated changes in total dredge volume and number of piles required, so that the correct worst case scenario can be assessed. In addition, we note that the updated layout will be assessed using hydrodynamic modelling to predict the magnitude and extent of changes in the Environmental Statement.	The full Project details are provided in the parameters section of **Chapter 2: The Project [TR030008/APP/6.2]**. The worst case parameters have been included within the numerical modelling assessment.
Second Statutory Consultation May 2023 – July 2023	Marine Management Organisation	The MMO has no additional comments to make at this stage regarding Coastal Processes, however, our previous comments from the last round of consultation, dated 16 February 2023, remain outstanding despite this PEIR addendum submission.	Noted. All comments received from the Marine Management Organisation (“MMO”) have been captured within the physical processes assessments.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Second Statutory Consultation May 2023 – July 2023	Lincolnshire Wildlife Trust	**Capital Dredging and Maintenance Dredging** LWT is pleased to see that the level of dredging required for the Project has now reduced with the decision to implement one berth instead of two. However, the details of dredging works remain vague at this time, and LWT will continue to monitor this as more information is given. Our concerns regarding capital dredging and maintenance dredging were not addressed in the updated documents for this Second Statutory Consultation. Therefore, we have included our previously stated views in an appendix (Appendix A) to this letter.	The potential effects arising from the capital and maintenance dredging (if required) have been fully assessed within this chapter. This has included numerical modelling to inform the assessments.

16.3 Legislation, Policy and Guidance

16.3.1 **Table 16-2** presents the legislation, policy and guidance relevant to physical processes assessment and details how their requirements have been met.

Table 16-2: Relevant legislation, policy and guidance regarding Physical Processes

Legislation/Policy/Guidance	Consideration within the ES
The Marine and Coastal Access Act 2009 ("MCAA") (Ref 16-1)	
The MCAA provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment. The MCAA established the Marine Management Organisation ("MMO") as the organisation responsible for marine planning and licensing. The Project will require a Marine Licence for the elements of the works below Mean High Water Springs including dredging, disposal and placing or removing objects on or from the seabed. For Nationally Significant Infrastructure Projects ("NSIPs") the Development Consent Order ("DCO") where granted may include provision deeming a marine licence to have been issued under Part 4 of the Marine and Coastal Access Act 2009. The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO.	Information relevant to the marine licensing process is provided in the ES including characterisation of the physical processes baseline (**Section 16.6**) and an assessment of the exposure to change and potential impacts (**Section 16.8**).
The Planning Act 2008 (2008 Act) (Ref 16-2)	
Whilst the MCAA regulates marine licensing for works at sea, section 149A of the 2008 Act enables an applicant for a DCO to include within the Order a Marine Licence which is deemed to be granted under the provisions of the MCAA.	Information relevant to the marine licensing process is provided in the ES including characterisation of the physical processes baseline (**Section 16.6**) and an assessment of the exposure to change and potential impacts (**Section 16.8**).
The Water Environment ("WFD") (England and Wales) Regulations 2017 (Ref 16-3)	
The Water Framework Directive (2000/60/EEC) is transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 as	The WFD surface water bodies are described in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**. A WFD Compliance Assessment has been prepared to support the DCO application. This includes consideration of the potential risks for several key receptors, including hydromorphology. The WFD Compliance Assessment

Legislation/Policy/Guidance	Consideration within the ES
amended, known as the Water Framework Regulations[1]. In terms of water and sediment quality, *"Good ecological status/potential"* has regard to physico-chemical quality elements, and specific pollutants. The Good ecological status/potential assessment also considers biological and hydromorphological elements. "Good chemical status" has regard to a series of priority substances and priority hazardous substances.	has been informed by the outcomes of the physical processes assessment reported within this chapter.
The Conservation of Habitats and Species Regulations 2017 (Ref 16-4)	
The Habitats Directive and Birds Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2017 as amended, known as the "Habitats Regulations"[2]. The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European Sites. The Regulations also require the compilation and maintenance of a register of European sites, to include Special Areas for Conservation ("SACs") (classified under the Habitats Directive) and Special Protection Areas ("SPAs") (classified under the Birds Directive). These sites form the Natura 2000 network. These regulations also apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), candidate SACs ("cSAC"), potential Special Protection Areas ("pSPA"), and proposed and existing European offshore marine sites.	**Section 16.6** characterises the baseline for physical processes. An assessment of the exposure to change and potential impacts is described in **Section 16.8** which has informed the assessment of impacts on protected habitats and species presented in **Chapter 9: Nature Conservation (Marine Ecology)** and **Chapter 10: Ornithology [TR030008/APP/6.2]**. In particular information is provided with respect to the following potential impact pathways: • Physical damage through disturbance and/or smothering of supporting habitats and associated prey resources for interest features. • Physical damage through alterations in physical processes of supporting habitat for interest features. • Non-toxic contamination through elevated SSC resulting in effects on interest features, or their prey resources. A Shadow Habitats Regulations Assessment ("Shadow HRA") has been prepared to inform the Appropriate Assessment ("AA") and is provided in **[TR030008/APP/7.6]** as part of the Habitats Regulations Assessment ("HRA"). This report will inform the consultation process and will aid the Competent Authority in determining whether the Project has the potential for a likely significant effect ("LSE") on the interest features and/or supporting habitat of a European/Ramsar site either alone or in-combination with other plans, projects and activities and, if so, will inform the requirement to undertake an

1 Following the UK leaving the EU, the main provisions of the WFD have been retained in English law through The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

2 Following the UK leaving the EU, the Conservation of Habitats and Species Regulations 2017 have been modified by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

Legislation/Policy/Guidance	Consideration within the ES
	AA of the implications of the proposals in light of the site's conservation objectives and will inform the stage 2 AA of whether the Project will have an adverse effect on integrity of the protected sites.
The Waste (England and Wales) Regulations 2011 (as amended) (Ref 16-5)	
The Regulations set out the measures required for the prevention of, production and management of waste. This describes the purpose of a waste prevention program with waste prevention measures and makes reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks. It also outlines the waste hierarchy which ranks waste management options according to what is best for the environment. It gives top priority to preventing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then recovery, and last of all disposal (e.g. landfill). For any dredging project, the *in situ* characteristics of the material (physical and chemical), the method and frequency of dredging (and any subsequent processing), determines its characteristics in the context of securing a consent that is in compliance with the waste hierarchy. This understanding is central to the consideration of management options for dealing with dredged material in light of the requirements of the Regulations. Where prevention of the dredging is not possible, then the volume to be dredged should be minimised, and options for the re-use of the material, recycling and other methods of recovery must be considered in the first instance. In the context of re-use and recycling of dredge material this could include engineering uses, agricultural and product uses, environmental enhancement or post treatment of the dredge material to change its character with a view to determining a potential use. Should no practical and cost-effective solutions be identified, only then can options for the disposal of the dredged material be considered. These include marine disposal in licensed deposit sites or land-based disposal in terrestrial landfill.	**Section 16.6** provides baseline information on sediment characteristics. This information has informed a Waste Hierarchy Assessment ("WHA") for the Project to determine the Best Practical Environmental Option ("BPEO") for dealing with the dredge arisings (see **Appendix 2.A [TR030008/APP/6.4]**). The WHA has been informed by the outcomes of this physical processes assessment. The option of disposal in the estuary has been assessed as part of this physical processes assessment and is described in **Section 16.8**.

Legislation/Policy/Guidance	Consideration within the ES
National Planning Policy Statement for Ports ("NPSfP") (Ref 16-6)	
The NPSfP provides the policy framework for nationally significant infrastructure projects involving new port development (Department for Transport, 2012). In order to meet the requirements of the Government's policies on sustainable development, the NPSfP requires that new port infrastructure should also, amongst other things, assess the impact on coastal processes, be adapted and resilient to the impacts of climate change and provide high standards of protection for the natural environment. It also advises in Paragraph 5.3.5 that applicants should assess the impact of the proposed project on coastal processes and geomorphology, including by taking account of potential impacts from climate change. If the development has an impact on coastal processes, the applicant must demonstrate how the impacts will be managed to minimise adverse impacts on other parts of the coast. Paragraph 5.3.5 of the NPSfP advises that applicants also to assess the vulnerability of the proposed development to coastal change in the context of climate change during the project's operational life and any decommissioning period. Paragraph 5.3.8 states that the decision-maker should be satisfied that the proposed development will be resilient to coastal change, taking account of climate change, during the project's operational life and any de-commissioning period.	A physical processes chapter has been prepared for the ES. An assessment of the exposure to change and potential impacts on physical processes is described in **Section 16.8**.
UK Marine Policy Statement ("MPS") (Ref 16-7)	
The MPS is the framework for preparing marine plans and taking decisions affecting the marine environment. The MPS also sets out the general environmental, social, and economic considerations that need to be taken into account in marine planning and provides guidance on the pressures and impacts that decision makers need to consider when planning for and consenting development in the UK marine areas. Section 2.6.8 of the MPS is relevant to the Physical Processes assessment. In particular,	A physical processes chapter has been prepared for the ES. An assessment of the exposure to change and potential impacts on physical processes is described in **Section 16.8**. Where relevant mitigation has been considered in **Section 16.7**.

Legislation/Policy/Guidance	Consideration within the ES
paragraph 2.6.8.4 states, amongst other things, that - *"Marine plan authorities should be satisfied that activities and developments will themselves be resilient to risks of coastal change and flooding and will not have an unacceptable impact on coastal change...".* In addition, paragraph 2.6.8.6 notes that the impacts of climate change throughout the operational life of a development should be taken into account in assessments, and that any geomorphological changes that an activity or development has on coastal processes, including sediment movement, should be minimised and mitigated.	
UK Marine Strategy (Ref 16-8)	
The aim of the UK Marine Strategy is to protect the UK's marine environment. The Strategy sets out a comprehensive framework for assessing, monitoring, and taking action to achieve the UK's shared vision for clean, healthy, safe, productive, and biologically diverse seas. It aims to achieve good environmental status of marine waters by 2020 (followed by a six-year review) and then to protect the resource base upon which marine-related economic and social activities depend. The Strategy constitutes a vital environmental component of future maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment. The UK Marine Strategy applies to the landward boundary of coastal waters as defined under the WFD (i.e., from mean high water springs ("MHWS")) to the outer limit of the UK Exclusive Economic Zone ("EEZ"), as well as the area of UK continental shelf beyond the EEZ. Government reporting against the Strategy is a cyclical process, and the most recent assessments and Marine Strategy documents were updated in 2019.	The anticipated pressures exerted on the marine environment by the Project are considered to be of sufficiently small magnitude, in the context of UK Marine Regions, that they are unlikely to be a significant issue. The Strategy is, therefore, not considered further in this ES with regards to the physical processes assessment.
East Inshore and East Offshore Marine Plans (Ref 16-9)	
The first Marine Plans include the East Inshore and East Offshore Marine Plans, which are collectively referred to as 'the East Marine Plans'. These were formally adopted on 2 April 2014.	With respect to this physical processes assessment, the future baseline is discussed in **Section 16.6**, to provide context to the predicted changes (as a result of the Project) which are described in **Section 16.8**.

Legislation/Policy/Guidance	Consideration within the ES
There are no policies within the East Marine Plans related specifically to coastal processes. Policy CC1, however, states that: *"Proposals should take account of:* *• how they may be impacted upon by, and respond to, climate change over their lifetime; and* *• how they may impact upon any climate change adaptation measures elsewhere during their lifetime. Where detrimental impacts on climate change adaptation measures are identified, evidence should be provided as to how the proposal will reduce such impacts."*	
Flamborough Head to Gibraltar Point Shoreline Management Plan ("SMP") (Ref 16-10)	
The Flamborough Head to Gibraltar Point SMP identifies the most sustainable approach for managing the risk from coastal flooding and erosion over the short, medium and long-term. It covers the Humber Estuary coastline up to Immingham.	The ES recognises that the Project lies adjacent to Policy Unit L 'East Immingham to Cleethorpes' where the policy in the short, medium and long term is 'Hold the Line', which will influence current and future baseline conditions (**Section 16.6**).
North East Lincolnshire Local Plan 2013 to 2032 (Ref 16-11)	
The North East Lincolnshire Local Plan was adopted in 2018 and covers the period 2013 to 2032. Within its Spatial Portrait, the Local Plan highlights the importance of the 'Estuary Zone' of the local authority area, which includes the 'nationally important port' of Immingham. When considering the detail of how the economy of the area will be developed, the Plan specifically identifies at the outset that there are good expectations of growth within the ports and logistics sector. On the policies map which accompanies the Local Plan, the Site of the Project is shown as being located within an area identified as 'Employment – Operational Port'. In addition, Policy 34 of the plan makes clear that: *"Water management* *1. Development proposals that have the potential to impact on surface and ground water should consider the objectives and*	The Project is located largely within the administrative area of North East Lincolnshire, although elements of the marine infrastructure fall beyond the local Council's administrative boundary. Consideration of impacts on physical processes is provided in **Section 16.8**. This has also been assessed in **Appendix 17.A [TR030008/APP/6.4]** which will be submitted with the DCO application and considers WFD objectives as outlined in the Humber River Basin Management Plan.

Legislation/Policy/Guidance	Consideration within the ES
programme of measures set out in the Humber River Basin Management Plan." The Humber River Basin Management Plan provides a framework for protecting and enhancing the benefits provided by the water environment within the Humber River Basin District and informs decisions on land-use planning. The Humber River Basin District covers an area of 26,100 km² and extends from the West Midlands in the south, northwards to North Yorkshire and from Staffordshire in the west to part of Lincolnshire and the Humber Estuary in the east	
PINS Advice Note Eighteen: The Water Framework Directive (Ref 16-12)	
Advice Note Eighteen explains the information that the Inspectorate considers an applicant must provide with their NSIP application in order to clearly demonstrate that the WFD and the Water Environment ("WFD") (England and Wales) Regulations 2017 have been appropriately considered. The Advice Note also refers to Environment Agency guidance (as described above) in terms of the WFD process and the information required. Furthermore, the guidance describes the relevant bodies to be consulted in the pre-application process, and the presentation of information.	The WFD Compliance Assessment for the Project (**Appendix 17.A [TR030008/APP/6.4]** contains the information specified in this guidance as appropriate. The WFD Compliance Assessment has been informed by the outcomes of the physical processes assessment in **Section 16.8**.

16.4 Assessment Method

16.4.1 The physical processes assessment applies the same principles as the impact assessment methodology as described in **Chapter 5: EIA Approach [TR030008/APP/6.2]** and assesses the potential 'exposure to change' resulting from the impact pathways that have been scoped into the assessment. However, in most instances the methods adopted for the assessment of the physical processes changes differs slightly to those adopted for other environmental topics. This is because whilst the Project has the potential to cause changes to hydrodynamic and sedimentary processes, these changes are not, in themselves, generally recognised as environmental features/ receptors and, therefore, do not equate to 'effects'. The effects would instead be the consequence of these changes on other environmental features. For example, 'changes' in the transport and deposition of sediment may 'effect' the structure and function of marine habitats and their associated species.

16.4.2 The consequent significance of effects resulting from changes in physical processes on other environmental features/receptors have been assessed in other topic-specific ES chapters, including **Chapter 9: Nature Conservation (Marine Ecology)**; **Chapter 10: Ornithology**; **Chapter 15: Historic Environment (Marine)**; **Chapter 17: Marine Water and Sediment Quality**; and **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

16.4.3 Where changes in physical processes may potentially impact on physical environmental receptors, such as the local coastline and the nearshore sandbank and channel system, along with existing berth and jetty infrastructure, an assessment of effect significance is undertaken following the methodology presented in **Chapter 5: EIA Approach [TR030008/APP/6.2]**. In accordance with published guidance and an established approach that has been used in numerous previous EIAs, the assessment includes an evaluation of the importance/value and sensitivity of relevant physical processes receptors.

Data and Information Sources

16.4.4 The description of the existing baseline draws on available information from new and existing surveys, reports, dredging records and publicly available data. Additional, project-specific surveys have also been undertaken and used to inform this baseline characterisation. The following data key data sources have been used:

a. Hydrodynamic data collected by ABPmer between 12 August 2022 and 03 March 2023 at the location of the Project (**Appendix 16.C [TR030008/APP/6.4]**).

b. Available hydrodynamic data across the wider study area, including within the vicinity of the Port.

c. Bathymetric survey data collected by ABPmer in the vicinity of the proposed marine works in July 2022, along with a repeat bathymetric survey conducted by ABP in 2023 (**Appendix 16.B [TR030008/APP/6.4]**).

d. Site-specific marine sediment samples collected in 2022 and 2023 within the boundaries of the Project marine infrastructure works area for particle size analysis (“PSA”).

e. Historic marine surface sediment samples (2001) collected in the area of Immingham Outer Harbour (“IOH”) for PSA analysis.

f. Numerical modelling tools developed specifically for the Project and covering the assessment of hydrodynamic, wave and sediment transport impacts for the proposed works (jetty construction and potential for dredging and disposal).

g. Various ABPmer reports covering project work for ABP in and around the Immingham region.

h. Guidance documents relevant to the study, including Environment Agency Coastal Flood Boundary datasets for extreme events; UK Climate Projections ("UKCP18") for influence of future climate change.

Limitations and Assumptions

16.4.5 The information presented in this assessment reflects the proposed parameters and design for the Project as described in the parameters section of **Chapter 2: The Project [TR030008/APP/6.2]**.

16.4.6 This assessment has been undertaken based on the following assumptions:

a. The Project is implemented as described in **Chapter 2: The Project [TR030008/APP/6.2]** (with regards berth pocket location, depths, jetty and pontoon pile locations and dimensions).

b. Numerical modelling is based on a scenario with all elements of infrastructure in place and is considered a 'worst-case' scenario.

c. Capital dredging would be undertaken by backhoe dredger (e.g., Mannu Pekka or similar) with disposal at the Clay Huts disposal site (HU060) or the Holme Channel (HU056) disposal site. Maintenance dredging (if required at all) would be undertaken by Trailing Suction Hopper Dredger ("TSHD") with disposal at the Clay Huts disposal site (HU060). Dredge operations would be continuous and operate 24 hours a day and seven days a week until the full dredge volume has been removed (estimated to be 12 days).

d. Following construction of the Project, vessels operating from the newly constructed berth are assumed with dimensions described in **Chapter 2: The Project [TR030008/APP/6.2]**. Where a range of vessel sizes is possible, the largest dimensions have been used in this assessment as representative of a realistic worst case scenario.

e. That barge access to the disposal sites can be achieved throughout the full tidal cycle (this is considered to be a conservative, worst-case assumption for dredging and disposal operations and the subsequent plume development).

f. The capital dredge volumes assumed are a total of approximately 4,000m^3.

16.4.7 Whilst these are assumptions, the assessment within this ES has been undertaken considering the anticipated worst-case scenario in respect of physical processes receptors across the wider study area, including at the dredge, marine piling and disposal locations. Specific assumptions (and associated methodology) for each assessment are detailed in the relative sections of **Section 16.8**.

16.5 Study Area

16.5.1 The study area for this assessment is the area over which potential direct and indirect effects of the Project are predicted to occur during the construction and operational periods.

16.5.2 The direct effects on physical processes are those confined to the areas within the footprint of the Project, i.e., the jetties, dredged berth pocket and disposal of dredge material at the proposed disposal sites.

16.5.3 Indirect effects are those that may arise due to wider changes in the estuary flow and sedimentary regime and any associated change to the estuary morphology as a result of the Project.

16.5.4 As a consequence, the study area for the physical processes topic comprises the Site and the adjacent Immingham coastline, the existing jetties across the near-field and the central part of the Humber Estuary, the area generally between Sunk Dredged Channel ("SDC") and Halton Middle and the proposed spoil grounds HU056 and HU060. Within the far-field region, the study area includes the wider Humber Estuary from the mouth to up-estuary of the Hull Bend (see **Figure 16.1 [TR030008/APP/6.3]** for locations).

16.6 Baseline Conditions

Current Baseline

Bathymetry and morphology

16.6.1 In plan shape, the Humber Estuary has a meandering funnel shape widening towards the mouth, where a southerly orientated spit has formed in response to littoral drift processes and antecedent geological controls. The funnel shape is demonstrated by the exponential decrease in estuary area, width, and depth from the mouth to the head.

16.6.2 The estuary can be divided into three regions (see **Figure 16.1 [TR030008/APP/6.3]** for locations):

a. The Inner Humber (Trent Falls to Humber Bridge);

b. The Middle Humber (Humber Bridge to Grimsby); and

c. The Outer Humber (Grimsby to Spurn Point).

16.6.3 In the Inner Humber, downstream of Trent Falls, where the River Trent and River Ouse merge, the estuary is characterised by a number of extensive intertidal banks composed of sand/silt. These banks include Winteringham Middle Sand, Redcliff Middle Sand, Hessle Sand and Barton Ness Sand.

16.6.4 The Middle Humber, where the Project is located, is similar in its characteristics to the Inner Humber, having a number of banks and channels which have a preferred configuration. In the northernmost section, the main channel lies close to the Hull Waterfront, but westwards, where it meets Hessle Sand, a secondary channel develops along the southern shore. Down-estuary this reach is dominated by Skitter and Foul Holme Sands.

16.6.5 The Outer Humber is dominated by a three-channel system at the mouth (offshore of Spurn Head), a large, submerged sandbank (the Middle Shoal, located approximately in the middle of the estuary offshore of Grimsby), and a single deep channel leading to the Middle Humber. The three channels are Haile Channel (to the south of the mouth of the Humber), Hawke Channel (to the

northern side of the mouth, located off the tip of Spurn Head) and Bull Channel (in between the two). Up-estuary, Hawke Channel is extensively dredged and the resulting channel, known as SDC, provides shipping access to the ports of Immingham and Hull. The presence of boulder clay deposits in the Outer Humber provides a geological constraint that influences the position of some of the sand banks, intertidal areas and Spurn Point itself. The Outer Humber contains a number of disposal grounds.

16.6.6 The Humber Estuary has a macro tidal range, fast flows and a high background suspended sediment content. This means the bed of the estuary is very dynamic in its morphology, both in the short term and on longer time scales, particularly in areas where there are no constraints, either geological or man-made. This dynamism manifests itself in cyclical variations in the positions of channels and banks throughout different regions of the estuary, with many of these regions showing an interconnectivity of process. The dominant influences on morphological change are tides, waves and freshwater flows, tidal surges and biological activity.

16.6.7 These influences produce changes in SSC, deposition rates, bed composition and ultimately channel/bank configurations. The dynamic nature of the Humber is illustrated by the interactions existing between the various bank systems in the Inner and Middle Humber. Channel migration in the Inner Humber releases sand, which forms banks off Barton and New Holland in the Upper Middle Humber. Furthermore, there is a sediment exchange between Barton Ness Sand and Skitter Sand lower down the Humber, which ultimately helps determine the shape and levels across Halton Flats. This variability in the banks and channels has been particularly noticeable around the Hull Bend during the last circa 20 to 25 years, with large changes to the intertidal banks and secondary channels in the areas of Hull Middle, Skitter Sand and Halton Flats.

16.6.8 Further down-estuary, between Immingham and Grimsby, the estuary is at its deepest, and relatively speaking, this is its most stable location. The main channel varies between 10m and 20m below Chart Datum (“CD”) and is bounded by steep ‘hard sides’ thought to comprise boulder clay, which are relatively in-erodible to present-day hydrodynamics. On the south side of the channel a relatively wide and gently sloping shallow subtidal ‘ledge’ exists, predominantly associated with the construction of the Grimsby Dock System. To the north, near Hawkins Point, the intertidal area is narrow compared to the areas up and down the estuary. This is due to human intervention through the reclamation of Sunk Island in this area.

16.6.9 Across the Project, the near field bathymetry is influenced by the deeper approaches to the Port of Immingham (“The Port”) and the relatively shallower subtidal region behind the existing jetties (**Figure 16.2 [TR030008/APP/6.3]**. Bed elevation within the approaches to Immingham, the SDC and on the berths at Immingham Oil Terminal (“IOT”) varies in the approximate range of -8m to -20mCD. Across the Site, bed levels range from around -16mCD offshore, sloping up towards the land along the Immingham foreshore. The intertidal area adjacent to the Project is around 100m in width, narrowing slightly to the south, to around 80m south of the landward end of the jetty(s).

16.6.10 A review of historical bathymetric charts extending both up and down estuary of the Project shows that in the 1930s, the channel up estuary was considerably deeper than present day, with depths of the order of -16mCD centred about 1km from the shoreline. The channel has consistently in-filled until about 1990, resulting in a depth of around -7mCD. During the last 15 years, depths have been relatively stable, although variations between -6m and -7m CD have occurred in Whitebooth Road (**Figure 16.1 [TR030008/APP/6.3]**. Around the Site (including Stallingborough Flats and the wider Immingham frontage), bed levels have remained relatively stable over time.

Tides and water levels

16.6.11 The Humber Estuary is macro tidal with a mean spring tidal range of 5.7m at Spurn increasing to 7.4m at Saltend then decreasing to 6.9m at Hessle, which is 45km inland. Tides are semi diurnal with a slight diurnal inequality (one slightly higher high water followed by a slightly lower one), amounting to a 0.2m difference in high water spring tides at Immingham. Standard tidal levels at Immingham are provided in **Table 16-3**.

Table 16-3: Standard tide levels for Immingham

Tidal Level		Immingham	
		mCD	mODN
Highest Astronomical Tide	HAT	8.00	4.10
Mean High Water Springs	MHWS	7.30	3.40
Mean High Water Neaps	MHWN	5.80	1.90
Mean Sea Level	MSL	4.18	0.28
Mean Low Water Neaps	MLWN	2.60	-1.30
Mean Low Water Springs	MLWS	0.90	-3.00
Lowest Astronomical Tide	LAT	0.10	-3.80
Mean Spring Tidal Range	(MHWS – MLWS)	6.40m	
Mean Neap Tidal Range	(MHWN – MLWN)	3.20m	
Note: Conversion from mCD to mODN at Immingham = -3.90m.			

Source: Ref 16-13

16.6.12 The Humber tides are driven by the amphidromic system centred off the west coast of Denmark in the central North Sea. As the tide passes south of North Shields, it enters shallow water conditions which amplify the tidal range. This amplified tidal range drives the Humber tidal system so that the macro tidal range within the estuary is a product of the general morphology of the east coast as well as of the estuary itself.

Extreme water levels

16.6.13 Current extreme predictions determined by the Environment Agency for Immingham are the most up-to-date and appropriate for this review (Ref 16-14), as recommended by current guidance. These are provided in **Table 16-4** for a baseline year of 2017.

Table 16-4: Predicted extreme water levels for the Port of Immingham (Ref 16-14)

Return Period (Years)	Annual Exceedance Probability (%)	Extreme Water Level (mODN)
1	100	4.15
2	50	4.25
5	20	4.40
10	10	4.51
20	5	4.62
25	4	4.66
50	2	4.77
75	1.3	4.85
100	1	4.90
150	0.67	4.97
200	0.5	5.03
250	0.4	5.06
300	0.33	5.10
500	0.2	5.20
1,000	0.1	5.34
10,000	0.01	5.85

16.6.14 The maximum water level currently recorded at Immingham occurred on 5 December 2013 at 19:00 hours with a level of 5.22m Ordnance Datum Newlyn ("ODN") compared to the predicted 3.69m ODN; therefore, the meteorological surge effect during the recorded event was 1.53m.

Sea level rise

16.6.15 The above data do not allow for sea level rise in the future. In order to take into account future sea level rises, and given an assumed engineering design standard of 50 years from 2023, the latest UKCP18 (Ref 16-18) relative sea level research and assuming a Representative Concentration Pathway ("RCP") 8.5 (95%ile) scenario will add 0.52m to the water levels provided in **Table 16-4**.

Flows

16.6.16 Flow speed data has been obtained from the United Kingdom Hydrographic Office ("UKHO") Admiralty Tidal Diamond, located within the main channel, approximately 2km up-estuary of the Project. The variation in the tidal flow conditions is provided in **Table 16-5**.

16.6.17 Bespoke, site-specific hydrodynamic information has also been collected. During this sevenmonth period, depth averaged current speed values peaked at *circa* 1.5m/s on the ebb tide and *circa* 1.3m/s on the flood tide on the spring tide phase. During a neap tide phase, peak values were *circa* 0.8m/s (ebb) and *circa* 0.4m/s (flood).

16.6.18 Current directions were generally aligned with the orientation of the estuary throughout a tidal cycle, remaining consistent throughout the duration of the flood with WNW flow (between 290°N and 295°N). During the ebb, flows were also generally uniform, with initially ESE flows (*circa* 120°N) becoming more E (*circa* 100°N) approaching LW. A current rose, showing the collected survey data, is provided in **Figure 16.3 [TR030008/APP/6.3]**.

Table 16-5: Tidal flow conditions from the closest Admiralty Tidal Diamond (Ref 16-13)

Time (hours)	Direction (going to °N)	Spring rate (m/s)	Neap rate (m/s)
-6	132	1.30	0.41
-5	239	0.10	0.10
-4	303	1.10	0.57
-3	305	1.70	0.87
-2	314	1.60	0.87
-1	315	1.50	0.57
HW	319	0.67	0.15

Time (hours)	Direction (going to °N)	Spring rate (m/s)	Neap rate (m/s)
1	122	0.67	0.36
2	133	1.70	0.72
3	129	2.10	1.20
4	132	2.30	1.40
5	126	1.80	1.30
6	132	1.50	0.82

16.6.19 The predicted flow data from further up-estuary reveals that the flow regime in this area remains generally rectilinear, with flows aligned approximately east-southeast on the ebb to west-northwest on the flood. Peak flows here of around 2.1m/s are predicted during the ebb tide, with notably slower flows on the flood phase of the tide, resulting from the relative effects of the shallow 'shelf' of Stallingborough Flats and the drag effects from IOT.

Waves

16.6.20 From available data, the wave climate across the Site is generally protected from large waves approaching from the North Sea by a combination of sheltering effects (from Spurn Head and the various banks and channels within the outer parts of the Humber Estuary).

16.6.21 Measured data from the Project oceanographic survey campaign has also been used to provide a more detailed description of the local wave climate.

16.6.22 This measured data, from the Project AWAC deployment (**Appendix 16.C [TR030008/APP/6.4]**), reveals wave heights were generally less than 0.8m and showed a semi-diurnal relationship with water level (highest heights over HW periods and lowest heights around LW), indicating most were locally wind generated. A maximum wave height H_{max} of 1.19m was observed on 3 September 2022, with an elongated period of higher wave heights between 16-18 September 2022 resulting from predominantly northerly wind conditions.

16.6.23 Peak wave period (T_p) generally remained between 2s and 5s, with mean wave period (T_z) between 1s and 3s. Similar to wave height, a semi-diurnal relationship of wave period and water level can be established, indicating most waves are locally wind generated. Occasionally larger T_p between 6s and 10s were isolated values with little or no respective increase in T_z values. These are likely a result of vessel wakes from commercial shipping approaching/exiting IOT and Immingham Dock. Although these are correctly derived values by the AWAC instrument, a large proportion have been flagged during the data Quality Assurance process and should be treated with caution.

16.6.24 Wave direction was generally variable, although with a slight bias from E and NE sectors between 45°N and 110°N which reflects the deployment location in relation to the estuary. Between 16 to 18 September 2022, waves were concentrated from a N direction (315°N-360°N). This period resulted in a small increase in wave heights above routine values. A wave rose, showing the collected survey data, is provided in **Figure 16.3 [TR030008/APP/6.3]**.

Geology and sediments

16.6.25 The underlying solid geology of the Humber is Upper Cretaceous Chalk. Locally there are two formations: Flamborough Chalk and Burnham Chalk. The younger Flamborough Chalk has identifiable bedding surfaces, distinct marl bands and is without flint. The underlying Burnham Chalk, which subcrops along the eastern part of the Site, is thinly bedded and laminated and contains continuous flint bands. The Port is located at a point where the Burnham Chalk Formation is not covered by the Flamborough Chalk Formation (Ref 16-15).

16.6.26 The chalk surface is characterised by a highly fractured zone created by glacial and periglacial processes, and overlain by Pleistocene deposits of Glacial Till. These glacial and post-glacial sequences are subsequently overlain by fine-grained (Clay and Silt) Tidal Flat Deposits.

16.6.27 The Humber lies in a complex of solid and superficial geology which can be simplified into three groups: the pre-Quaternary, the glacial (or Quaternary) and Post Glacial (or Holocene).

16.6.28 The estuary upstream of the Humber Bridge represents an older estuary system formed in the last interglacial (120,000 to 80,000 years Before Present) with the estuary mouth at this time being located near the current Humber Bridge. Downstream of this point, the estuary is more recent in geological terms, the channel having formed in immediate post glacial times as melt water cut down through glacial till deposits. During the post glacial period of Sea Level Rise (“SLR”), the former river channel underwent marine transgression and became subject to estuarine sedimentation.

16.6.29 The sediment budget of the Humber Estuary has previously been informed, by historic analysis of data between 1946 and 2000 (comprising approximately three complete nodal tidal cycles) (Ref 16-16). It is noted that there is a high degree of variability in the underlying data, so regression coefficients calculated during the analysis are poor (although the relationships are statistically significantly different from ‘no trend’). The three main sediment sources for the Humber Estuary are its tributaries, the North Sea (in the form of background suspended sediment) and the eroding Holderness coast. The exchange between the rivers and the sea is an order of magnitude smaller than the flux of sediment through the mouth on each tide and the inputs and outputs on each tide are very much smaller than the volume of sediment held in suspension and continually moving within the Estuary. A summary of the sediment budget is provided in **Table 16-6**.

Table 16-6: Net sediment budget model for the Humber Estuary (Ref 16-16) (based on analysis of data between 1946 and 2000)

System Element	Sediment load and rate of exchange with the Estuary (+ve indicates an input; -ve indicates a removal) (tonnes per tide)
Humber Estuary	$1.2x10^6$ tonnes
River inputs	+335
Intertidal accretion	-4
Subtidal erosion	+145
Cliff erosion	+7
Saltmarsh deposition	-11
Met marine exchange	-472
Average tidal flux	$\pm 1.2x10^5$

16.6.30 The bed sediments within the vicinity of the study area are understood to be a mixture of muds and sands. Previous sampling in the Immingham area has also identified the potential for chalk outcrops at depth. The benthic sampling, undertaken during July 2022 as part of the Project study, collected eight sediment samples within, and adjacent to, the proposed berth dredge (see **Figure 16.4 [TR030008/APP/6.3]** for locations). The bed samples were subsequently analysed for PSD, in order to characterise the bed material across the Site. The majority (five of the eight samples) are classified as 'sandy Mud' (Ref 16-17), with the remainder comprising 'Mud' (see **Figure 16.4 [TR030008/APP/6.3]** for the PSD of the Site and **Table 16-7** for summary PSD information). Previous sampling has also collected grab samples across the two disposal sites (HU056 and HU060). PSD information for these samples (see **Figure 16.4 [TR030008/APP/6.3]** for locations) are also provided in **Table 16-7**, revealing a mixture of sediment type, with varying proportions of sand, mud and gravel.

16.6.31 Across the eight sediment samples collected as part of the baseline studies carried out for the Project, the average bed composition is 76% mud, 24% sand and no gravel material. Within the proposed dredge pocket, these average values shift slightly towards the coarser particles with 69% mud and 31% sand. As noted above, the majority of locations (all within the proposed dredge pocket) are categorised as 'sandy Mud' (Ref 16-17), with locations 01, 02 and 03 (inshore of the dredge pocket) defined as 'Mud'.

16.6.32 Measurements of SSC previously collected from the Immingham area, show that during ebb tides peak SSC can vary from a few hundred mg/l to over 1,000 mg/l, during larger spring tides. The SSC levels are also generally higher on spring tides (approximately double the concentrations observed on neap tides) and during the winter months, compared to summer months. The Project oceanographic survey has collected information on suspended sediments, which has been used to detail the local characteristics.

16.6.33 Additional Vibrocore samples (further information provided in Section 17.6 of **Chapter 17: Marine Water and Sediment Quality** of the ES **[TR030008/APP/6.2]**), collected in March 2023 in and around the dredge pocket and at varying depths, show the predominant sediment compositions to be 'muddy Gravel' (39%), 'gravelly Mud' (23%) and 'sandy Mud' (16%). The average percentage composition of the sediments collected and sampled were:

a. Mud – 57.36%
b. Sand – 15.84%
c. Gravel – 26.80%

Table 16-7: Particle size distribution across the Project and disposal sites

Sample	Percentage composition (%)			Sediment description*	Mean grain size (d50) (µm)
	Mud	Sand	Gravel		
1	96.69	3.31	0.0	Mud	7.8
2	94.11	5.89	0.0	Mud	8.2
3	96.32	3.68	0.0	Mud	7.0
4	71.10	28.90	0.0	Sandy Mud	20.1
5	57.35	42.65	0.0	Sandy Mud	27.7
6	63.76	36.24	0.0	Sandy Mud	23.6
7	71.51	28.49	0.0	Sandy Mud	17.9
8	55.43	44.57	0.0	Sandy Mud	30.6
HU56_01	0.0	100.0	0.0	Sand	159.0
HU56_02	1.6	84.0	14.4	Slightly Gravelly Muddy Sand	186.1
HU56_03	37.1	16.2	46.6	Muddy Gravel	83.8
HU56_04	16.3	12.1	71.5	Gravelly Mud	17.7
HU56_05	18.7	80.1	1.2	Gravelly Sand	707.9
HU56_06	35.0	17.0	48.0	Muddy Gravel	73.7

Sample	Percentage composition (%)			Sediment description*	Mean grain size (d50) (µm)
	Mud	Sand	Gravel		
HU60_01	0.0	100.0	0.0	Sand	230.7
HU60_02	0.0	100.0	0.0	Sand	227.7
HU60_03	0.4	61.7	37.9	Slightly Gravelly Muddy Sand	148.1
HU60_04	0.0	100.0	0.0	Sand	232.7
HU60_05	0.0	100.0	0.0	Sand	202.1
HU60_06	0.0	100.0	0.0	Sand	223.6
* Sediment description after Ref 16-17					

16.6.34 In addition to the bed sampling described above, a full-spread geophysical survey has also been carried out across the Site to provide a general description of the sub-bottom geology, provided below.

16.6.35 Results from a combination of Side Scan Sonar and Multibeam Echo Sounder data show five seabed sediment classifications: Mixed Sediment, muddy SAND, firm CLAY, soft MUD and rock protection. Firm CLAY has been marked tentatively as an increase in soil strength is only supported by an increase in reflectivity, rather than having been verified by ground truthing. Bespoke Ground Investigation ("GI") works are currently underway.

16.6.36 Four main types of sub-surface units have been identified, also with sub-units. The geological model has been informed by background site information and geotechnical work carried out previously at, or near to, the survey area. The uppermost unit is comprised of alluvium deposits that can be further subdivided into surficial sediments composed of soft silt/mud with a depth range between 0 to 3.0m below seabed.

16.6.37 The uppermost unit is comprised of surficial alluvium deposits composed of soft SILT/CLAY and SAND with a depth range between 0.0m – 4.8m below seabed. A layer of interpreted boulder clay underlies the alluvium which has been interpreted as the Upper Boulder Clay unit. The Upper Boulder Clay ranges between 0.0m – 10.6m below seabed and is largely observed to exist in tandem with the underlying Lower Boulder Clay which appears to completely erode away towards the north. The Lower Boulder Clay unit is observed to exist between 0.0m – 15.0m below seabed in the survey area. Discontinuous lenses of SAND/GRAVEL are also noted within this unit. The bedrock has been identified as CHALK from geotechnical data. The surface of the CHALK has been observed in the seismic data at depths between 0.0m – 15.0m below seabed. The bedrock level below seabed shoals to the north where it is observed at or close to the riverbed.

16.6.38 Two small, isolated regions of acoustic attenuation are observed, likely caused by moderate accumulation of organic matter within the surficial sediments.

16.6.39 There is good confidence in the geophysical interpretation in the deeper waters (proposed berth area) at the northeast of the survey area due to the chalk horizon being clearly observed reaching the seabed and correlating with results of the recent sediment sampling (vibrocore) campaign.

Future Baseline

16.6.40 Hydrodynamic and sedimentary processes will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns and trends (e.g., ongoing maintenance dredging and disposal) with or without the Project.

16.6.41 The future baseline would also be influenced by climate change and, in particular, increased rates of mean sea level rise. Projections of change for Immingham up to 2100 are 0.99m (based on UKCP18 RCP 8.5 95%ile climate change scenario). Water levels in the future, as now, would also be affected by unpredictable surge and weather-related events. These parameters have been factored into the assessment of potential changes to physical processes introduced via the Project.

16.7 Design, Mitigation and Enhancement Measures

Embedded Mitigation Measures

16.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects on physical processes through the process of design development, and by embedding mitigation measures into the design, such as minimising the dredge requirements as far as possible in the context of the existing bathymetry.

Standard Mitigation Measures

16.7.2 Standard mitigation measures would be implemented to manage commonly occurring environmental effects. Although these are not likely to alter the assessment conclusions, they are considered to be standard good practice and are taken account of in the initial impact assessment. In terms of physical processes, the following standard mitigation measure would be implemented:

a. **Even disposal deposition**: The targeting of disposal loads in the central/deeper areas of the disposal sites (HU056 and HU060) would be undertaken to reduce depth reductions. This would minimise the initial reduction in water depth and any environmental changes at these disposal sites.

16.8 Potential Impacts and Effects

16.8.1 This section identifies the potential likely effects on the physical processes receptors as a result of the construction and subsequent operation of Project **Figure 16.5 [TR030008/APP/6.3]**.

16.8.2 Cumulative impacts on physical processes that could arise as a result of other developments and activities in the Humber Estuary are considered as necessary as part of the cumulative impacts and in-combination effects assessment (**Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**).

Construction

16.8.3 This section contains an assessment of the potential impacts of the construction phase of the Project. Numerical modelling is based on a scenario with all elements of infrastructure in place including the berth and is considered a 'worst-case' scenario in terms of potential impacts on hydrodynamics.

16.8.4 The following construction activities and impacts have been identified and considered:

a. Capital dredge and disposal and marine piling works:

   i Increased SSC and potential sedimentation over the extent of the disturbance plume as a result of the construction of the new jetty (piling) and capital dredging works.

   ii Increased SSC and potential sedimentation as a result of the deposit of capital dredge material at a licensed offshore disposal site(s).

   iii Changes in seabed bathymetry and composition as a result of deposition of dredged/disposal material within the area of the respective plumes.

b. Changes in local flow speeds (and potential impact on local sediment dynamics) as a result of construction vessel activity (ship wash, vessel propulsion etc.).

Capital dredge and disposal and marine piling - potential impact on SSC and sedimentation

16.8.5 The disposal of dredged material at sea associated with the Project would be fulfilled at licensed disposal sites HU056 (for any inerodible boulder/glacial clay) and HU060 (for any sand/silt (alluvium) material) (see **Chapter 2: The Project [TR030008/APP/6.2]**).

16.8.6 The potential impact of dredge arisings (and spoil from removal to licensed disposal sites) on SSC and sedimentation has been assessed. However, the disposal activity is considered to result in a larger extent and magnitude of impact than that arising from the dredge (as a result of the relative volumes and methods). The approach uses the dredge volumes provided by the project engineers and expert knowledge of the likely dredging process and of the availability of open disposal sites. The assessment is informed by application of the calibrated numerical hydrodynamic modelling tool, which drives a Danish Hydraulic Institute ("DHI") particle tracking module.

16.8.7 It is anticipated that the dredging for the berth pocket would be undertaken by a backhoe dredger and would be supported by split barges on a continuous cycle to the disposal grounds. This dredging method has been assessed here as a worst-case for potential impact on SSC (resulting from release of material throughout the water column during both dredging and disposal – see assumptions in **Section 16.4**). The number of barges would be determined by the barge loading time and the time of transit to and from the disposal grounds so that the backhoe dredger is never stood idle, meaning the works would be a 24/7 operation until dredging is complete. The assessment is based on barge access to the disposal sites being achieved throughout the full tidal cycle (see **Paragraph 16.4.6**). Current dredge volume estimates (based on the latest available site-specific geotechnical and geophysical information) are for a total of approximately 4,000m^3 of material.

Dredging of the proposed berth(s) and associated disposal at HU060

16.8.8 Based on previous experience, the following assumptions have been made in relation to the berth dredge:

a. Backhoe bucket size of 8m^3.

b. Average bucket cycle time of 2 minutes.

c. Working capacity of barge = 950m^3.

d. A continuous barge operation would provide maximum production and greatest potential for magnitude in plume.

e. Typical rates, vessel speeds and distance to disposal site have been used to calculate typical dredge cycle times.

16.8.9 In addition, the following details have also been assumed in respect of the plume assessment, based on an understanding of the method and equipment to be used:

a. Distance from dredge to disposal site is approximately 1.1 nautical miles and the assumed load service speed is eight knots.

b. Barge deposit time is ten minutes.

c. Characteristic sediment distribution is informed by the bed sampling (detailed in **Table 16-7** to this chapter, with a mean grain diameter of around 20µm.

d. Inputs to the plume modelling from the dredge are applied both at the bed and also uniformly through the water column, arising from bucket lowering, bed ripping, water column wash and slewing (breaking the water surface).

e. Inputs to the plume modelling from the deposit at the disposal site are applied both at the bed (from the deposit) and also just below the surface (from the initial release, based on the loaded draught of the barge).

f. At the disposal site, the sediment predominantly falls to bed as a density current and is then available for onward advection through bed erosion processes.

16.8.10 Using the above assumptions, the model assesses the repeating cycle of (dredging at the planned berth pocket and subsequent) disposal at HU060. Consequently, the basis of the assessment assumes continuous dredging (of the full dredge volume) at the proposed berth location(s) and a disposal (over a ten minute period) at HU060 every four hours.

16.8.11 The deposits at HU060 have been assessed, as this site is likely to receive the vast majority of the more unconsolidated dredged material. If required, HU056 would be used for the disposal of any inerodible boulder clay, which is considered likely to remain on the bed, without resulting in a significant plume of material. As a consequence, disposal activities at HU056 have not been modelled as the impacts are considered to be well within the magnitude and extent of the envelope of impact defined by the assessment of material at the HU060 disposal site (included in this assessment).

Spatial dispersion of dredge plume and sedimentation

16.8.12 Following the repeating schematic dredge cycle the particle tracking model has been run with sequential dredge, disposal, dredge, cycles. The initial dredge commences during a mean spring tide and the cycle repeats until the full dredge volume (4,000m^3) has been deposited. Dredge locations within the berth pocket are switched between either end of the berth pocket, whilst disposal inputs are to the centre of the HU060 disposal site.

16.8.13 **Figure 16.6 [TR030008/APP/6.3]** shows the maximum spatial extent of the disposal SSC plume at HU060 over the full dredge and disposal campaign (covering both peak flood and peak ebb tidal flows (on a spring tide). The output, therefore, shows the maximum extent of excess SSC and sedimentation resulting from the assessed repeating 'dredge > disposal…' cycle (**Figure 16.6 [TR030008/APP/6.3]**).

16.8.14 For dredge arisings disposed at the HU060 site, it is anticipated that material would initially remain in suspension (when deposited during flood or ebb tidal flows), before settling to the bed during slack water around high water ("HW") and low water ("LW") periods. Once deposited to the bed, the material would return to the background sedimentary system for subsequent transport under flood or ebb tidal flows. Maximum SSC levels are associated with the disposal activities (with relatively small increases in SSC arising from the dredge itself). Peak excess SSC levels resulting from the disposal activities are around 600-800 mg/l at the spoil ground, reducing to typically 100-200 mg/l with distance from the source. Upstream of Hull, maximum SSC levels are lower; generally, between 20 and 100 mg/l, as the tidal excursion from the disposal site limits the extent of the resultant plume.

16.8.15 In practice, due to the high magnitude of (and wide envelope of variability in) background SSC levels, the predicted increase in concentrations resulting from the disposal activities is likely to become immeasurable (against background) within approximately 1km of the disposal site. Furthermore, the effects of the proposed disposal operations are considered to be no different to those arising from the ongoing maintenance dredge/disposal activities that are carried out at the adjacent Immingham berths. The measurable plume from each disposal

operation is only likely to persist for a single tidal cycle (less than 6 hours from disposal). After this time, the dispersion under the peak flood or ebb tidal flows means concentrations would have reverted to background levels. Increased concentrations arising from the dredge operations are of lower magnitude and persist over a shorter distance (and time) than that from the disposal.

16.8.16 Associated sedimentation **Figure 16.6 [TR030008/APP/6.3]** to the bed extends up- and down-estuary from the disposal site. Peak sedimentation depths are around 1-2mm within a distance of around 1km from the disposal site. At the dredge location, increased sedimentation above 0.5mm is predicted within around 500m (aligned to the flow vectors) up- and down-stream of the dredged pocket. Outside of these areas, the majority of deposition levels across the study site are negligible. Once on the bed, the deposited material returns to the background system to be put back into suspension on subsequent peak flood or ebb tide to be further dispersed.

16.8.17 Example timeseries plots of predicted excess SSC and associated sedimentation (from the combined dredge/disposal operations) are provided in **Figure 16.7 [TR030008/APP/6.3]** for two locations – one just up-estuary and one just down-estuary of the HU060 disposal site. In each case, peak SSC and sedimentation values are predicted at the disposal site whilst, at locations approximately 1.5km up- and down-estuary, the timeseries plots show the temporal nature of the excess material. Each disposal results in peak SSC of around 100-200 mg/l at the selected locations (approximately 1.5km from the disposal source). Each peak in SSC generally persists for a single timestep before the tidal forcing transports the plume further up/down estuary on the prevailing flood/ebb tide, respectively. Due to the timing of successive disposal events, there is no evidence of cumulative increases in SSC (i.e. the impact from each disposal is dispersed sufficiently before the next disposal, such that there is no predicted positive trend in excess SSC with sequential disposal events).

16.8.18 Associated with this, each disposal operation results in sedimentation of around 1-2mm at locations around 1km from source. Once deposited, this material remains on the bed during slack water periods, before being put back into suspension on the subsequent flood or ebb tide. Thus, material is returned to the existing (baseline) sediment regime, retained within the wider Humber Estuary system following disposal at HU060.

16.8.19 It should be noted that the map plots in **Figure 16.6 [TR030008/APP/6.3]** do not show the instantaneous SSC and sedimentation levels at any given point in time, rather they show the maximum SSC and sedimentation value at any location during the complete model run time. As a result, the plots show the extent of overall effect from the dredge and the disposal within the estuary, without reference to how soon after commencement of operations they occur, nor how long these values persist at any given location. In contrast, the successive temporal plots provided in **Figure 16.8 [TR030008/APP/6.3]** show the instantaneous extent and magnitude of excess SSC (and associated sedimentation) following a number of consecutive disposal events.

Assessment of exposure to change

16.8.20 The greatest increase in SSC from the marine piling, dredging and disposal activities would occur during the barge depositing material at the licensed disposal site. Material within the passive plume would be dispersed throughout the water column as the load drops to the bed, with the potential to be transported up- and down-estuary through the full tidal excursion (dependent on tidal state at the point of release). Initial SSC values within the dynamic plume would be very high but, given the very high natural levels within the estuary, excess levels are likely to be reduced to below natural storm disturbance conditions very quickly (and before the next disposal operation commences four hours later). This is typically the same scenario that occurs for the existing maintenance dredging of the local Immingham berths, which has been undertaken frequently (multiple times during the year) since the berths were first implemented.

16.8.21 At the disposal site, the effect of deposition of capital dredge arisings would be similar to that which already occurs as a result of ongoing maintenance dredging and disposal. Local changes to the bathymetry (as a result of material disposal to the bed) within the disposal site would be small in the context of the existing depths. As is currently the practice, disposal activity would be targeted to the deeper areas within the site, ensuring that bed level changes are not excessive in any one area, thus minimising the overall change. As a result, associated changes to the local hydrodynamics (and sediment transport pathways) would be negligible.

16.8.22 The local hydrodynamics, the existing (background) SSC levels within the wider Humber Estuary and the proposed dredge and disposal works have all been considered within this assessment. Overall, the increase in SSC and potential sedimentation in the marine environment is likely to be the same as that which already occurs from existing maintenance dredging in the area (which has been occurring for many years). Moreover, peak increases would remain within the envelope of natural variability in background SSC. As a result, the probability of occurrence is considered high although the magnitude of change is assessed as small, resulting in an overall **low** exposure to change.

Construction vessel activity – impacts on local hydrodynamics and sediment transport arising from ship wash and vessel propulsion

16.8.23 Piling and decking for the approach jetty and piers are being constructed using land-based plant and equipment, and by quasi-stationary floating and jack-up barges. Consequently, the only vessels associated with the construction phase are the dredgers and barges for the capital works and slow-moving jack-ups that, once in position, effectively remain stationary whilst carrying out the works. The majority of the material would be removed with a backhoe dredger to a hopper (for subsequent disposal). Whilst the optimal size of the dredging plant would need to be determined by the specialist dredging contractor, the backhoe method effectively uses stationary plant to dredge a defined area, with the plant moving across the dredge site until all the required material has been removed. In this way, the construction vessel movements are generally limited in frequency to the movements across the dredge area, rather than being continuous throughout

dredge operations. Due to water depths across the wider area, it is further considered likely that dredging plant would access the berth pocket from offshore, meaning that any ship wash and vessel propulsion effects on local flow speeds are anticipated to occur away from the adjacent foreshore.

Assessment of exposure to change

16.8.24 There is predicted to be a generally limited temporal impact from the construction vessel movements (with infrequent movements across the berth pocket), coupled with the likely extent of effect being limited to the deeper, offshore side of the Site. As a result, it is unlikely that there would be any notable impact on local flows across the adjacent intertidal area and, by association, no likely impact on local accretion or erosion processes. Consequently, the probability of occurrence is considered medium although the magnitude of change is assessed as small, resulting in an overall **low/negligible** exposure to change.

Operation

16.8.25 This section contains an assessment of the potential impacts as a result of the operational phase of the Project. The following operational elements and impacts have been assessed:

a. Marine facilities (approach jetty and dredge pocket):
   - i Local changes to hydrodynamic regime (flow speed and direction) as a result of the piers (piling) and the implementation of the new berth pocket.
   - ii Associated local changes to the sediment transport pathways, as a result of localised changes to the driving hydrodynamic (and wave) forcing.
   - iii Local changes to the wave regime, as a result of the piers (piling) and the implementation of the new berth pocket.
   - iv Potential impacts on existing features, including existing marine infrastructure, outfalls and estuary banks and channels.

b. Maintenance dredging - potential impact on SSC and sedimentation:
   - i Increased SSC and potential sedimentation in the area of dispersal plume as a result of maintenance dredging.
   - ii Increased SSC and potential sedimentation as a result of deposition of maintenance dredge material at a licensed disposal site.
   - iii Changes in seabed bathymetry and composition as a result of deposition of dredged/disposed maintenance dredge material.

Marine facilities (approach jetty, jetty head and dredge pocket) - potential impact on hydrodynamics

16.8.26 An assessment of impacts on hydrodynamics has been carried out using numerical modelling tools and conceptual analysis (see **Paragraph 16.1.7**). The modelling has been completed using an updated version of the existing calibrated and validated MIKE FM HD model of the Humber Estuary. The updated model mesh has been refined around the study area and adjacent coastline.

16.8.27 The bathymetric datasets used in the creation of the model mesh consist of a combination of survey data collected for the Project, existing data provided by the Applicant in and around Immingham, along with topographic LiDAR data from the Environment Agency Open Data portal.

16.8.28 The updated model has been subject to new calibration and validation using survey data for the local area. Calibration and validation have been undertaken over a spring and neap tide. Full details of the model setup, calibration and validation are provided in **Appendix 16.A [TR030008/APP/6.4]** .

16.8.29 Although not specifically shown on a figure within this assessment, it should be noted that the assessment of the Project on local hydrodynamics reveals no impact on water levels across the near- or far-field area. Consequently, water levels across the existing berths are not predicted to change as a result of the Project.

16.8.30 The predicted impacts on the local flow regime, obtained through hydrodynamic modelling of the area, are summarised both spatially, in the immediate vicinity of the approach jetty, jetty head and dredge pocket, and temporally at a series of point locations identified as strategic locations and areas of greatest importance.

16.8.31 The spatial hydrodynamic effects of the marine facilities (approach jetty, jetty head and berth pocket) are shown in **Figure 16.9 [TR030008/APP/6.3]** for the approximate time of peak flood and ebb spring flows. Initial results of the hydrodynamic modelling show that the Project causes generally small impacts, confined predominantly to the vicinity of the structure and adjacent IOT.

16.8.32 During the flood tide (**Figure 16.9 [TR030008/APP/6.3]**), the extent of effect as a result of the Project is approximately 2km up estuary from the west edge of the berth pocket, across IOT and Humber International Terminal (“HIT”). Along IOT, flow speeds are reduced by < 0.3m/s on the eastern end of the jetty, and by <0.2m/s at the western end. By the time flows reach HIT, the flow speed reductions are < 0.1m/s. At the western edge of the berth pocket, flows are reduced by up to 0.31m/s. Small increases in flow speeds are seen just to the north of the jetty head, and to the south along the shore frontage; the magnitude of these changes is < 0.1m/s.

16.8.33 These changes in flow speed on the flood tide are relatively small with regards to the baseline flow speeds. Baseline flows are between 1.2 and 1.3m/s in the area of interest. As a result, maximum predicted changes in flow speed as a result of the Project generally tend to be limited in extent to the dredge pocket itself and are around -20% of baseline flow speeds. Further afield, changes remain constrained to the area adjacent to the berth, with relative flow speed changes generally around -5%.

16.8.34 On the ebb tide (**Figure 16.9 [TR030008/APP/6.3]**), the assessment shows a similar pattern of change to the flood tide, however, the reduction in flow speed occurs for approximately 2.5km down estuary from the eastern end of the jetty head. Here, there are flow speed reductions of < 0.6m/s. However, this quickly reduces to around a 0.4 and 0.3 m/s reduction 500m and 1km downstream, respectively. In the berth pocket itself, flow speeds are reduced by up to 0.2m/s. South of the Project, flow speeds are slightly increased, by around 0.1m/s moving towards the shoreline.

16.8.35 As with the flood tide, these changes in flows speed are relatively small in relation to the baseline flows speeds. Baseline flows vary from approximately 1.6m/s to approximately 1.7m/s in the area of interest. As a result, predicted reductions in ebb flow speed within the dredge pocket generally tend to be up to around -18% of baseline flow speeds. To the east of the jetty head, flow speeds reduce by up to 30% of the baseline, reducing to -5% 1km downstream of the Project.

16.8.36 Timeseries plots have been provided to illustrate a predicted temporal change throughout the spring tide at key locations. These are provided in **Figure 16.10** to **Figure 16.12 [TR030008/APP/6.3]**.

16.8.37 At P1 (**Figure 16.10 [TR030008/APP/6.3]**, approximately 3km downstream of the Project, changes in flow speeds on the flood tide would be negligible, and on the ebb tide, flow speeds would be reduced by approximately 0.05m/s.

16.8.38 At P2 and P3 (**Figure 16.10 [TR030008/APP/6.3]**, within 500m of the eastern end of the jetty head, changes in flow speed on the flood tide would again be negligible. On the ebb tide, flow speeds at both P2 and P3 are reduced by up to 0.25m/s.

16.8.39 Within the dredge pocket (locations P4 and P5), a general decrease in flow speeds is predicted (**Figure 16.10** and **Figure 16.11 [TR030008/APP/6.3])** on the flood tide at both locations, flow speeds are reduced by up to 0.4m/s. On the ebb tide, flows speeds at P4 are reduced by approximately 0.3m/s, whilst at P5, reduction in flow speeds are negligible.

16.8.40 At P7 and P8 (**Figure 16.11 [TR030008/APP/6.3])**, in front of IOT, and P9 (**Figure 16.11 [TR030008/APP/6.3])** (500m northwest of IOT) flow speeds are reduced by up to 0.25m/s on the later stage of the flood tide. On the ebb tide, changes in flow speeds are negligible.

16.8.41 At P10 (**Figure 16.12 [TR030008/APP/6.3]**), approximately 3.5km upstream of the Project in front of the Humber International Terminal, flow speeds on the flood tide are reduced by less than 0.05m/s, whilst changes in flow speed on the ebb tide are negligible.

16.8.42 At P6, P11 and P12 (**Figure 16.12 [TR030008/APP/6.3]**), south of the Project, just in front of the foreshore, flow speeds are slightly increased by up to 0.05m/s on both the flood and ebb tides, although changes in flow speeds on the ebb tide at P12 are negligible. At each of these locations, associated changes to bed shear stress are typically negligible in the context of the thresholds of motion for the typical bed material. The potential for changes to sediment transport pathways is considered further in the sections below.

Inclusion of vessels on-berth

16.8.43 Assessment of the hydrodynamic impacts during the operational phase of the development has considered the effect of one vessel berthed at the jetty, in addition to the pontoon structures themselves and dredged pocket – i.e., equivalent to maximum development case.

16.8.44 The assessment has also conducted a sensitivity test, which has considered one vessel on berth with a Length Overall of 250m; breadth of 37m and draught of 12.8m.

16.8.45 The spatial hydrodynamic effects of the operation of the Project with a vessel on-berth are shown in **Figure 16.13 [TR030008/APP/6.3]** for the approximate time of peak flood and ebb spring flows. Results of the hydrodynamic modelling show that with a vessel alongside, the Project causes relatively small impacts, which are confined to within 2km of the facility.

16.8.46 Along IOT, flow speeds are reduced by up to 0.3m/s (24% of baseline flows) on the eastern end of the jetty, and by < 0.2m/s (12%) at the western end. By the time flows reach HIT, the flow speed reductions are < 0.1m/s (5%). At the western edge of the berth pocket, flows are reduced by up to 0.5m/s (38%). Small increases in flow speeds are seen just to the north of the jetty head, and to the south along the shore frontage of < 0.1m/s.

16.8.47 On the ebb tide (**Figure 16.13 [TR030008/APP/6.3]**), the assessment shows a similar pattern of change to the flood tide, however, the reduction in flow speed occurs for approximately 3km down estuary from the eastern end of the jetty head. Here, there are flow speed reductions of up to 0.6m/s. However, this quickly reduces to a 0.4 and 0.2 m/s reduction 500m and 1km downstream, respectively. South of the Project, flow speeds are slightly increased by around 0.1m/s moving towards the shoreline. These results are typically the same as those described above for the ‘scheme without vessel’ scenario.

Assessment of exposure to change

16.8.48 Marginal changes to hydrodynamics (local flow speed) are likely to result from the Project within, and adjacent to, the proposed berth pocket. Slight changes in flow speed are predicted to extend up-estuary to Immingham Outer Harbour and IOT and down-estuary. The largest predicted magnitude of change is anticipated within the berth pocket itself and the eastern and western end of the jetty head. The probability of occurrence is, therefore, considered high, although the magnitude of change is assessed as small, giving rise to an overall **low** exposure to change.

Marine facilities (approach jetty, jetty head and dredge pocket) – potential impact on sediment transport

16.8.49 Changes to the local hydrodynamics, as a result of the Project (as described above) have the potential to affect local sediment transport (i.e., faster flows may increase bed erosion, and lower flows may encourage sedimentation).

16.8.50 To investigate the potential impact of the marine facilities on sediment transport, the movement of fine-grained material (as identified across the Project grab sampling survey) has been investigated using the MIKE Mud Transport ("MT") module. The model is driven by the outputs of the hydrodynamic model described above and verified against local dredge records and SSC measurements. The model setup and validation are described in **Appendix 16.A [TR030008/APP/6.4]**.

16.8.51 The modelling tool has been applied to model the existing baseline for the Project, and the difference in bed thickness over a 15-day mean spring-neap cycle has been calculated.

16.8.52 **Figure 16.14 [TR030008/APP/6.3]** shows the predicted difference (to baseline) in bed thickness change, as a result of the Project, over a mean spring-neap tidal cycle. It is predicted that the changes in accretion and erosion patterns are generally small in both magnitude and extent. The slight reduction in flow speeds within (and adjacent to) the dredged berth pocket and across the leeward side slopes result in a very small associated change to bed shear stress ("BSS"), allowing for slightly reduced erosion over the baseline condition (i.e. the dominant process within the berth pocket is still for erosion, but at a slightly reduced potential). The predicted change is very small in magnitude (resulting change in bed level of less than 0.1m) and limited in extent to part of the Site underneath the piled jetty head. This indicates that the berth pocket, once dredged, would remain swept clear of deposited material by the flood and ebb tidal flows (in much the same way as the existing IOT berths are). Consequently, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).

16.8.53 In addition to the predicted reduced erosion along parts of the proposed berth pocket side slopes, local increases in peak flood and ebb current speed at the landward end of the proposed I approach jetty (**Figure 16.9 [TR030008/APP/6.3]**), result in associated slight increases to BSS. These lead to a slight increase in predicted erosion of the bed at the elevation of MLWS, beneath the landward end of the proposed jetty. **Figure 16.14 [TR030008/APP/6.3]** shows the difference in bed thickness change against the baseline, with negative values indicating areas of either increased erosion or of reduced accretion. Over a mean spring neap cycle, the predicted erosion is less than 0.1m, resulting in a potential indirect loss in intertidal area of up to 0.03ha. The assessment indicates that once this part of the softer upper layer is removed, the harder, more consolidated, underlayer of bed material is unlikely to erode further. This calculation represents a worst-case assessment of potential elevation changes and has been considered on a precautionary basis. The level of predicted change is at the limit of the accuracy of the modelled data and, in

real terms, is likely to be immeasurable against the context of natural variability (as a result of storm events, for example).

16.8.54 Across the wider study area (including the existing berths at IOT, the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates (**Figure 16.14 [TR030008/APP/6.3]**). Overall, there is predicted to be limited magnitude and extent of predicted change, resulting from the Project (in terms of both hydrodynamics across the range of tidal states and the associated negligible impact on estuary tidal prism and far-field sediment transport pathways). This, coupled with the in-estuary disposal of capital and maintenance dredge material (thus maintaining the sediment as part of the wider estuary sediment budget), indicates that the Project would not result in long-term changes to the wider estuary morphology.

Assessment of exposure to change

16.8.55 Hydrodynamic forcing within (and adjacent to) the Project would only be marginally altered and, therefore, changes in the sediment pathways would be small. Predicted changes to future sediment transport are small in magnitude and limited in extent to the berth pocket and the landward end of the approach jetty. Outside the proposed berth pocket, the Project has limited impact on the baseline sedimentation and erosion rates.

16.8.56 As a result, the probability of occurrence is considered to be high, and the magnitude of change is assessed as small, resulting in an overall **low** exposure to change. With specific reference to the identified physical processes receptors (the existing infrastructure, the coastline along the Immingham frontage, existing outfalls and the local banks and channels), the exposure to change is assessed as **low** over the near-field and **negligible** over the far-field, resulting in and overall impact assessment of **insignificant**.

Marine facilities (approach jetty, jetty head and dredge pocket) - potential impact on waves)

16.8.57 Impacts on waves have been assessed using numerical modelling tools and conceptual analysis. The modelling has been completed using the existing (updated, as described) calibrated and validated MIKE SW model of the Humber Estuary. The model examines how wave conditions would be affected during extreme and more frequently occurring events.

16.8.58 The model utilises the same bathymetric data as the hydrodynamic model (as described above).

16.8.59 The updated model has been subject to performance checks by simulating wave conditions at the Site, over a short period during which waves have been recorded at the Site during the Project AWAC deployment (for discrete periods between 2020 and 2022). Full details of the model setup and verification are provided in **Appendix 16.A [TR030008/APP/6.4]**.

16.8.60 The assessment of potential wave impacts from the Project has defined a set of wave conditions (including Hs, peak wave period (Tp) and wind speed ("WS")), for a range of return periods and for a number of approach directions (described further in **Appendix 16.A [TR030008/APP/6.4]**. These wave events have then been applied to the numerical model under existing (baseline) and Project scenarios. The predicted differences in modelled wave heights, as a result of the berth pocket dredge, have then been calculated.

Table 16-8: Extreme boundary wave conditions for the Humber Spectral Wave Model

Return period (yr)		North-easterly	Easterly	South-easterly
		All Year	All Year	All Year
0.5	Hs (m)	3.4	2.4	2.4
	Tp (s)	9.0	6.7	5.6
	WS (m/s)	15.0	13.0	15.0
50	Hs (m)	5.2	4.1	4.8
	Tp (s)	11.1	8.7	7.9
	WS (m/s)	23.0	21.0	25.0

16.8.61 The spatial wave effects of the construction of the Project are shown in **Figure 16.15** to **Figure 16.17 [TR030008/APP/6.3]** for each of the events modelled in **Table 16-8**. The results of the wave modelling show that the Project results in generally small impacts, confined predominantly to the area in the vicinity of the structures.

16.8.62 The greatest effect on wave height for the 0.5-yr, north easterly event is seen along the jetty head, with reductions in wave height of up to 0.25m on the western end and 0.2m on the eastern end (**Figure 16.15 [TR030008/APP/6.3]**). Along the approach jetty, a decrease in wave height of up to 0.13m is seen, extending back from the berth pocket towards the foreshore. This reduction in wave heights continues south of the jetty head, towards the foreshore. At the foreshore, wave height reductions are less than 0.1m. A slight reduction in wave height of < 0.1m also extends to the eastern end of IOT. There is also a small, predicted reduction in wave height (also < 0.1m) in the southwest corner of the berth pocket. Baseline wave heights for this event tend to be in the region of 1.1m around the Project. The maximum predicted change in wave height is therefore around -25%. This change is limited in extent to the area immediately around the jetty platform.

16.8.63 For the 0.5-yr, easterly and south easterly event, it is shown that the impacts extend slightly further than those of the north easterly event (**Figure 16.15** and **Figure 16.16 [TR030008/APP/6.3]**. As with the north easterly event, the biggest impact is seen along the jetty head, with decreases in wave heights of up to 0.3m. The sheltering effect of the Project extends further west, across the IOT and towards Bellmouth. At this point however, wave height reductions are small (<0.1m). By the time it has reached the most eastern part of IOT, changes to baseline wave heights are negligible. The baseline wave heights for this event are approximately 1.2m, with a maximum decrease of 0.3m, which represents a change of around -25 % at the jetty head. Reductions in wave heights elsewhere represent a change of around -6%.

16.8.64 As with the 0.5-yr event, the greatest effect on wave height for the 50-yr, north easterly event is along the jetty head, with reductions in wave height of up to 0.35m (31% decrease from the baseline (**Figure 16.16 [TR030008/APP/6.3]**). A reduction in wave height of up to 0.16m continues south of the jetty head along the approach jetty, towards the foreshore. However, this quickly reduces to less than 0.1m within 50m east and west of the approach jetty.

16.8.65 For the 50-yr, easterly event, it is anticipated that the impacts would extend slightly further than those of the north easterly event (**Figure 16.17 [TR030008/APP/6.3]**). As with the north easterly event, the biggest impact is seen along the jetty head, with decreases in wave heights of up to 0.4m. The sheltering effect of the Project extends further west, across the IOT and towards Bellmouth. At this point, however, wave height reductions are negligible. Along the most western part of IOT, wave heights are reduced by less than 0.05m (2%). Within the western end of the berth pocket, wave heights are reduced by around 0.15m (7%).

16.8.66 The 50-yr south easterly event is similar in pattern and magnitude of effects on wave height as the easterly event, particularly along the jetty head (**Figure 16.17 [TR030008/APP/6.3]**). However, due to the higher baseline wave heights for this event, the relative (percentage) decrease in wave height is less than that for the easterly event. At the jetty head, wave heights are expected to decrease by up to 14%, whilst at IOT and towards the adjacent foreshore, wave heights are expected to decrease by less than 3% compared to the baseline.

Assessment of exposure to change

16.8.67 Marginal changes to significant wave height (Hs) are likely to result from the Project within, and adjacent to, the proposed berth pocket. For the various wave events assessed, slight changes in wave height (typically less than -6% of baseline values) are predicted to extend up-estuary as far as Bellmouth (for a wave event approaching from the southeast). The largest predicted magnitude of change is anticipated in the immediate vicinity of the jetty head.

16.8.68 The probability of occurrence is considered high, although the magnitude of change is assessed as small giving rise to an overall **low** exposure to change at this stage of the assessment.

Marine facilities (approach jetty, jetty head and dredge pocket) - potential impact on existing features, including marine infrastructure, outfalls and estuary banks and channels

16.8.69 Identified changes to the existing (baseline) hydrodynamics, waves and associated sediment transport pathways have the potential to impact existing features. Such features, which include existing marine infrastructure, land drainage outfalls and estuary banks and channels, have been identified in the relevant sections above and the potential impact from the Project is summarised here.

16.8.70 Changes to flows and waves are predicted to be generally limited in extent to around the Project marine facilities and in the immediate vicinity. The predicted impacts at the existing marine terminals (including IOT, Humber Sea Terminal, Immingham Eastern and Western Jetties, Immingham Outer Harbour and Immingham Gas Terminal) are (where predicted) generally small in magnitude. This is also the case for the adjacent foreshore areas fronting the Site, which include a number of outfalls. With distance from the Project, the predicted impacts reduce further and are not predicted to occur over the far-field region. Changes to local and regional sediment transport pathways have been modelled and are only predicted in close proximity to the marine elements of the Project, meaning the existing banks and channels of the wider Humber Estuary are not predicted to be impacted by the development.

Assessment of exposure to change

16.8.71 Changes to flows and waves are likely to result from the Project marine facilities within, and adjacent to, the proposed berth pocket and jetty infrastructure. These changes are predicted to be greatest in closest proximity to the Project, reducing in magnitude with distance. Due to the small extent and low magnitude of effect on the driving hydrodynamics, coupled with the relatively stable nature of the estuary morphology across the near-field study area, it is considered that the changes arising from the Project would not affect the existing, longer-term cyclic patterns in the estuary banks and channels.

16.8.72 Across the near-field, the probability of occurrence is considered high, although the magnitude of change is assessed as small giving rise to an overall **low** exposure to change. Across the far-field, the probability of occurrence is considered low, and the magnitude of change is assessed as negligible, giving rise to an overall **negligible** exposure to change.

Maintenance dredging - potential impact on SSC and sedimentation

16.8.73 The assessment of impacts on local and regional sediment transport pathways has been undertaken to inform the potential requirement for future maintenance dredging. The modelling indicates that the berth pocket, once dredged, would remain swept clear of deposited material by the flood and ebb tidal flows (in much the same way as the existing IOT berths are). Consequently, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all).

16.8.74 Outside of the berth(s), and particularly within the existing Immingham berths, the predicted changes to flow speed and wave height are generally negligible, and therefore it is considered unlikely that the proposed works for the Project would have any noticeable impact on existing maintenance dredge requirements along the remainder of the Immingham frontage. This is particularly true considering the range of natural variability in the annual maintenance requirements within the existing berths.

Assessment of exposure to change

16.8.75 It is considered that any future maintenance dredging (if required) would result in negligible changes in SSC and sedimentation. Furthermore, the predicted impacts from future maintenance dredging (if required) would be similar to that which already arises from the ongoing maintenance of the existing Immingham berths. As a result, the probability of occurrence is presently considered low and the magnitude of change is assessed as small, resulting in an overall **negligible** exposure to change.

16.9 Mitigation and Enhancement Measures

16.9.1 The exposure to change of all physical processes receptors as a result of the construction and subsequent operation of Project are considered to be Low at worst, and therefore, no additional mitigation measures are required.

16.10 Assessment of Residual Effects

Construction

16.10.1 None of the impact pathways identified for physical processes are expected to give rise to a measurable exposure to change. All potential effects during construction have been assessed as **not significant**.

Operation

16.10.2 All potential effects on impact pathways identified for physical processes during operation have been assessed as **not significant**.

Decommissioning

16.10.3 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on physical processes from decommissioning have been scoped out.

16.11 Summary of Assessment

16.11.1 A summary of the impact pathways that have been assessed, the identified residual effects and level of confidence are presented in **Table 16-9** to this chapter based on the current understanding. This assessment has focussed on the potential 'exposure to change' resulting from the impact pathways that have been scoped into the assessment.

16.11.2 Overall, the physical processes changes brought about by the construction and operation of the Project are currently considered small in both magnitude and extent and the resultant exposure to change assessed as low. These assessments have been informed through application of numerical modelling tools and consideration of predicted impacts against existing (baseline) characteristics. The confidence associated with the assessment is considered 'Medium' as it is based on site specific data, and conceptual understanding of the study area combined with numerical modelling. The numerical model is fully calibrated, however, it is recognised that such models represent a number of complex parameters within dynamic environments and as such there will always be a limit to the level of accuracy that can be achieved.

Table 16-9: Summary of potential impact, mitigation measures and residual effects

Receptor	Impact Pathway	Exposure to change	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Physical processes	Increased SSC and potential sedimentation over the extent of the disturbance plume as a result of the construction of the new piers (piling) and capital dredging works	Low	N/A	Low	Medium
	Increased SSC and potential sedimentation as a result of the deposit of capital dredge material at a licensed offshore disposal site	Low	N/A	Low	Medium
	Changes in seabed bathymetry and composition as a result of deposition of dredged/disposal material within the area of the respective plumes	Low	N/A	Low	Medium
	Construction vessel activity – impacts on local hydrodynamics and sediment transport arising from ship wash and vessel propulsion	Low/negligible	N/A	Low/negligible	Medium
Operational Phase					
Physical processes	Local changes to hydrodynamic regime (flow speed and direction) as a result of the piers (piling) and capital dredging	Low	N/A	Low	Medium
	Local changes to the wave regime, as a result of the piers (piling) and capital dredging	Low	N/A	Low	Medium

Receptor	Impact Pathway	Exposure to change	Mitigation Measure	Residual Effect	Confidence
	Associated local changes to the sediment transport pathways, as a result of localised changes to the driving hydrodynamic (and wave) forcing	Low	N/A	Low	Medium
	Potential impact on existing features, including marine infrastructure, outfalls and estuary banks and channels	Hydrodynamics: Low Sediment transport: Low	 N/A N/A	 Low Low	 Medium Medium
	Increased SSC and potential sedimentation in the area of dispersal plume as a result of maintenance dredging	Negligible	N/A	Low	Medium
	Increased SSC and potential sedimentation as a result of deposition of maintenance dredge material at a licensed disposal site	Negligible	N/A	Low	Medium
	Changes in seabed bathymetry and composition as a result of deposition of dredged/disposed maintenance dredge material	Negligible	N/A	Low	Medium

16.12 References

Ref 16-1 The Stationery Office Limited (2009). Marine and Coastal Access Act 2009.

Ref 16-2 The Stationery Office Limited (2008). Planning Act 2008.

Ref 16-3 The Stationery Office (2017a). Statutory Instrument 2017 No. 407. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Ref 16-4 The Stationery Office (2017b). Statutory Instrument 2017. No. 1012. The Conservation of Habitats and Species Regulations 2017.

Ref 16-5 The Stationery Office Limited (2011). Statutory Instrument 2011. No. 988. The Waste (England and Wales) Regulations 2011.

Ref 16-6 Department for Transport (2012). The National Planning Policy Statement for Ports. HMSO, London.

Ref 16-7 The Stationery Office Limited (2011). UK Marine Policy Statement.

Ref 16-8 Department for Environment, Food and Rural Affairs (Defra) (2019). UK Marine Strategy.

Ref 16-9 HM Government (2014). East Inshore and East Offshore Marine Plans.

Ref 16-10 Environment Agency (2010). SMP3: Flamborough Head to Gibraltar Point Shoreline Management Plan.

Ref 16-11 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan.

Ref 16-12 Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive.

Ref 16-13 UK Hydrographic Office (2022) Admiralty Tide Tables.

Ref 16-14 Environment Agency. (2018). Coastal flood boundary conditions for the UK: update 2018. Technical summary report. SC060064/TR6

Ref 16-15 British Geological Society (BGS) (2022). Geology Viewer.

Ref 16-16 ABPmer. (2004). Humber SMP2: Additional verification of morphological modelling, ABPmer Report No. R.1138. A report produced by ABPmer for Black & Veatch (on behalf of the Environment Agency), September 2004.

Ref 16-17 Folk, R.L. (1954). The Distinction between Grain Size and Mineral Composition in Sedimentary-Rock Nomenclature. Journal of Geology, 62, 344-359.

Ref 16-18 Palmer, M., Howard, T., Tinker, J., Lowe, J., Bricheno, L., Calvert, D., Edwards, T., Gregory, J., Harris, G., Krijnen, J., Pickering, M., Roberts C., Wolf J. (2018). UK Climate Projections Science Report: UKCP18 Marine report. Met Office Hadley Centre: Exeter.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 17: Marine Water and Sediment Quality

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 17: Marine Water and Sediment Quality

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

17 Marine Water and Sediment Quality

17.1 Introduction

17.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on Marine Water and Sediment Quality. It focuses specifically on changes in marine water and sediment quality as a result of piling, capital and maintenance dredging and disposal, as well construction-related accidental spillages.

17.1.2 The interrelationships related to the potential effects on Marine Water and Sediment Quality are addressed in the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 9: Nature Conservation (Marine Ecology)**

b. **Chapter 16: Physical Processes**

c. **Chapter 22: Major Accidents and Disasters**

17.1.3 This chapter is also supported by the following figures **[TR030008/APP/6.3]**):

a. **Figure 17.1**: Water Framework Directive ("WFD") water bodies

b. **Figure 17.2**: WFD protected areas

c. **Figure 17.3**: Water sampling location

17.1.4 Relevant aspects of the Marine Water and Sediment Quality assessment presented in this chapter will inform the WFD Compliance Assessment which will be prepared and included in the Environmental Statement ("ES") (**Appendix 17.A [TR030008/APP/6.4]**), and also the **Habitats Regulations Assessment** ("HRA") **[TR030008/APP/7.6]**.

17.2 Consultation and Engagement

17.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the Marine Water and Sediment Quality assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on Marine Water and Sediment Quality. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

17.2.2 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("The Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which formed part of the consultation.

17.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum formed part of the consultation.

17.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 17-1** . The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 17-1 Stakeholder consultation on marine water and sediment quality

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Opinion, 10 October 2022	Planning Inspectorate	The Scoping Report seeks to scope changes to levels of contaminants in water (construction and operation) out of the assessment on the grounds that the Proposed Development would not directly introduce contaminants to the marine environment and good practice measures would be used to minimise and mitigate the potential for accidental spillages during dredging and disposal. The Scoping Report does not specify what these measures would be although reference is made to 'Guidance for Pollution Prevention: Works and maintenance in or near water'). However, no other detail on the likely measures has been provided. Furthermore, the Scoping Report refers to accidental spillages during dredging and disposal but makes no mention of the potential for accidental spillages during operational activities (e.g. water discharges to the Humber, accidental spillages of fuel and cargo of liquid bulk vessels). In the absence of information such as evidence demonstrating clear agreement with relevant statutory bodies, the Inspectorate is not in a	An assessment of the risk of accidental spillages and associated potential impacts on water quality is provided in **Section 17.8**. Further information on mitigation measures that would be applied to minimise the risk of accidental spillages during construction and operational phases has been provided in **Section 17.7**. This also details the measures that would be in place were a spill to occur. Further information on the impact on water quality resulting from potential major accidents and disasters is also provided in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		position to agree to scope these matters from the assessment. Accordingly, the ES should include an assessment of these matters or the information referred to demonstrating agreement with the relevant consultation bodies and the absence of a likely significant effect. This should cross reference to Chapter 21 Major Accidents and Disasters.	
Scoping Opinion, 10 October 2022		In addition to the data sources listed in paragraph 16.2.1, the Applicant is directed to water quality data available on the Open WIMS database at https://environment.data.gov.uk/water-quality/view/landing	Environment Agency water quality monitoring data has been used to characterise the marine water quality baseline in **Section 17.6**.
Scoping Opinion, 10 October 2022		The ES should assess the potential for chemical contamination to accumulate at the dredge disposal sites.	**Section 17.6** compares sediment quality data from site-specific marine sediment sampling with the Centre for Environment, Fisheries and Aquaculture Science ("Cefas") Guideline Action Levels to determine the suitability of sediments for disposal at sea and to understand the impacts from redistribution of sediment-bound contaminants.
Scoping Opinion, 10 October 2022		The methodology does not describe how the significance of effects would be determined, or how the general methodology described in Chapter 4 of the Scoping Report would be applied to this aspect specifically. The	The assessment of impacts (i.e., how the significance of effects is determined) in this chapter follows the approach detailed in **Chapter 5: EIA Approach [TR030008/APP/6.2]**. This follows the Institute of Environmental Management and Assessment and the Chartered Institute of Ecology and Environmental Management guidelines. The impacts have been identified based on ABPmer's

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		ES should clearly explain how likely significant marine water and sediment quality effects have been identified.	previous (extensive) experience of port developments as well as consultation with stakeholders.
Scoping Opinion, 10 October 2022		Paragraph 16.6.3 indicates that contaminant concentrations in sediments would be compared to Cefas Guideline Action Levels for the Disposal of Dredged Material. These don't exist for all of the contaminants which could potentially be observed. The Applicant should consider if there is any potential to explore alternative guidance levels (e.g. those used by other agencies/countries) for contaminants not covered by the Cefas Guidelines.	Where Cefas Action Levels are not defined for certain contaminants, reference is made to other relevant thresholds/guidance as appropriate - this is noted in **Section 17.6**.
Scoping Opinion, 10 October 2022	Environment Agency	In addition to the data sources listed in paragraph 16.2.1, we would direct the Applicant to water quality data, which is available on the Open WIMS database at https://environment.data.gov.uk/water-quality/view/landing. The Report does not specifically discuss water discharges to the Humber. Paragraph 16.4.8 states that "Changes to levels of contaminants in	Environment Agency water quality monitoring data has been used to characterise the marine water quality baseline in **Section 17.6**. Discharges into the Humber Estuary are discussed in **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**. Any changes to, or potential impacts, on discharges will also be considered within the WFD Compliance Assessment (**Appendix 17.A [TR030008/APP/6.4]**). An assessment of the risk of accidental spillages and associated potential impacts on water quality is provided in **Section 17.8**. Further information on the impact on water quality resulting from potential major accidents and disasters is also provided in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**. Noted.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		water (including accidental spillages) during operation" is scoped out. Under the COMAH regulations, the site will be required to complete an unmitigated assessment of the environmental impact in the event of incidents. As such, undertaking this assessment of potential impact now may provide an early indication if the project will be required to go beyond best practice. If the project intends to discharge directly to the Humber it will need to follow this guidance Surface water pollution risk assessment for your environmental permit - GOV.UK (www.gov.uk) in support of its permit application. Paragraph 16.6.3 indicates that contaminant concentrations in sediments would be compared to Cefas Guideline Action Levels. These don't exist for all of the contaminants which could potentially be observed. The Applicant should consider if there is any potential to explore alternative guidance levels (e.g. those used by other agencies/countries).	Where Cefas Action Levels are not defined for certain contaminants, reference is made to other relevant thresholds/guidance as appropriate - this is noted in **Section 17.6**.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Statutory Consultation (PEIR) December 2022 – February 2023	Marine Management Organisation	The report states that Cefas Action Levels are not in place for various contaminants, and in their absence, other comparable tools such as the Canadian Sediment Quality Guidelines (CSQGs) or the OSPAR Action Levels of other signatory countries will be used to contextualise the contaminant concentrations. The MMO agree that this approach can be appropriate in some circumstances, though this will be dependent on the contaminants which will be tested for, i.e. it may be more appropriate to use the proposed Action Levels for PAHs (Ref 17-33) rather than the CSQG probable/threshold effect levels.	It is important to note that proposed updates to Cefas Action Levels are still subject to review and are not yet implemented. However, proposed Cefas Action Levels have been considered where existing Cefas Action Levels are not defined for certain contaminants in **Section 17.6** and compared with site-specific sediment quality data.
Statutory Consultation (PEIR) December 2022 – February 2023	Natural England	Chapters 16 and 17: Physical Processes and Marine Water and Sediment Quality Based on our current understanding, Natural England broadly agrees with the scope of the assessment set out in Chapters 16 and 17 of the PEIR, however, we note that the sediment sampling and physical process modelling is currently incomplete and therefore we may provide additional comments. We note that the Humber	Sediment sampling has been undertaken and the results are presented in **Section 17.6**. This data has informed the assessment in **Section 17.8**.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Estuary SSSI should be included in the assessment.	
Pre-application meeting, 20 April 2023.	Marine Management Organisation and Cefas	The meeting provided an update on the Project and focused on discussing comments received from the MMO and Cefas on the PEIR with respect to physical processes and water and sediment quality.	The scope of the environmental assessments has been completed taking on board consultee comments from this meeting which reflect those in the Marine Management Organisation's ("MMO") response to statutory consultation.
Second Statutory Consultation May 2023 – July 2023'	Marine Management Organisation	Very little detailed methodological information has been provided concerning how the change from two piers to one affects the volume and type of dredging and disposal that may be required. At the previous application stage, the PEIR described the dredging required to constitute 100,000 m^3, without specifying the dredge depth. Changes to the anticipated volumes, area, and depth of material to be dredged can significantly change the risk associated with a programme of works. In this respect, the information provided in the addendum is quite limited. However, as this is the PEIR stage, and exact methods required are yet to be finalised, and as bespoke sediment sampling is yet to be	Noted. The capital dredge volume is approximately 4,000m^3 (based on the latest available site-specific geotechnical and geophysical information). The required dredge depth would be approximately 14.5m below Chart Datum. A sediment contamination survey was undertaken in March 2023 to characterise the dredge material and to support the application to dispose of the dredge material at an existing licensed disposal site. This was undertaken in accordance with the MMO sample plan (SAM/2022/00106) which confirmed the suite of contaminants, number of samples, sample locations, replicates and sampling depth required, taking account of available guidelines for the management of dredge material to be disposed at sea.

Reference, Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		undertaken to support the development under OSPAR and the London Convention and Protocol, the MMO is content that this information is not essential at this point.	

17.3 Legislation, Policy and Guidance

17.3.1 **Table 17-2**: presents the legislation, policy and guidance relevant to the Marine Water and Sediment Quality assessment and details how their requirements will be met in the assessment.

Table 17-2: Relevant legislation, policy and guidance regarding Marine Water and Sediment Quality

Legislation/Policy/Guidance	Consideration within the ES
The Planning Act 2008 (Ref 17-2)	
Whilst the Marine and Coastal Access Act ("MCAA") regulates marine licensing for works at sea, section 149A of the Planning Act 2008 enables an applicant for a Development Consent Order ("DCO") to include within the Order a Marine Licence which is deemed to be granted under the provisions of the MCAA.	Information relevant to the marine licensing process is provided in the ES including characterisation of the marine water and sediment quality baseline (**Section 17.6**) and an assessment of impacts (**Section 17.8**).
The Marine and Coastal Access Act 2009 ("MCAA") (Ref 17-1)	
The MCAA provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment. The MCAA established the MMO as the organisation responsible for marine planning and licensing. The Project will require a Marine Licence for the elements of the works below Mean High Water Springs including dredging, disposal and placing or removing objects on or from the seabed. For Nationally Significant Infrastructure Projects ("NSIPs"), the DCO where granted may include provision deeming a marine licence to have been issued under Part 4 of the Marine and Coastal Access Act 2009. The MMO is responsible for enforcing, post-consent monitoring, varying, suspending, and revoking any deemed marine licence(s) as part of the DCO.	Information relevant to the marine licensing process is provided in the ES including characterization of the marine water and sediment quality baseline (**Section 17.6**) and an assessment of impacts (**Section 17.8**).
The Water Environment (WFD) (England and Wales) Regulations 2017 (Ref 17-3)	
The Water Framework Directive (2000/60/EEC) is transposed into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 as	**Section 17.6** identifies the relevant WFD water bodies (the Project lies within the Lower Humber water body in the Humber River Basin District) and **Section 17.8** provides an assessment of potential impacts on water bodies.

Legislation/Policy/Guidance	Consideration within the ES
amended, known as the Water Framework Regulations[1]. In terms of water and sediment quality, "Good ecological status/potential" has regard to physico-chemical quality elements, and specific pollutants. The Good ecological status/potential assessment also considers biological and hydromorphological elements. "Good chemical status" has regard to a series of priority substances and priority hazardous substances.	A WFD Compliance Assessment has also been undertaken to determine whether the Project complies with the objectives of the WFD (**Appendix 17.A [TR030008/APP/6.4]**).
WFD (Standards and Classification) Directions (England and Wales) 2015 (Ref 17-4)	
The Direction provides the allowable thresholds (Environmental Quality Standards ("EQS")) for surface and groundwater bodies in England and Wales. This sets annual average ("AA") concentrations and/or maximum allowable concentrations ("MAC") for priority substances and priority hazardous substances that are controlled under the Water Framework Regulations.	Reference is made to AA and MAC for priority substances and priority hazardous substances that are controlled under the Water Framework Regulations in **Section 17.6** and **Section 17.8** where available baseline water and sediment quality data are compared with guideline thresholds.
Bathing Water Regulations 2013 (Ref 17-5)	
The revised Bathing Water Directive (2006/7/EC) is implemented in England and Wales under the Bathing Water Regulations 2013 (as amended).	**Section 17.6** identifies relevant bathing waters (the nearest is located approximately 11.5km south east of the Project).
Nitrate Pollution Prevention Regulations 2015 (Ref 17-6)	
The Nitrate Pollution Prevention Regulations 2015 implement the Nitrates Directive (91/676/EEC) in England and Wales.	**Section 17.6** identifies relevant Nitrate Vulnerable Zones ("NVZ"). As the NVZ is landside this is considered in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**. NVZs have also been considered in the WFD Compliance Assessment (**Appendix 17.A [TR030008/APP/6.4]**).
Urban Waste Water Treatment (England and Wales) Regulations 1994 (Ref 17-7)	
The Urban Waste Water Treatment Directive (91/271/EEC) is implemented in England and Wales through the Urban Waste Water Treatment (England and Wales) Regulations 1994 (as amended). It aims to protect the environment from the adverse effects of the collection, treatment, and discharge of urban waste water.	**Section 17.6** identifies relevant Sensitive Areas. There are no sensitive areas designated under the Urban Waste Water Treatment Regulations in the vicinity of the Site.

[1] Following the UK leaving the EU, the main provisions of the WFD have been retained in English law through The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019. (Ref 17-31)

Legislation/Policy/Guidance	Consideration within the ES
Shellfish Water Protected Areas Directions 2016 (Ref 17-8)	
The Shellfish Water Protected Areas (England and Wales) Directions 2016 require that the Environment Agency (in England) endeavour to observe a microbial standard in all 'Shellfish Water Protected Areas'. The microbial standard is 300 or fewer colony forming units of *E. coli* per 100 ml of shellfish flesh and intravalvular liquid. The Directions also require the Environment Agency to assess compliance against this standard to monitor microbial pollution (75% of samples taken within any period of 12 months below the microbial standard and sampling/analysis in accordance with the Directions).	There are no Shellfish Water Protected Areas in the vicinity of the Project. **Section 17.6** explains that the nearest is the West Wash Shellfish Water Protected Area, located over 65km south.
The Conservation of Habitats and Species Regulations 2017 (Ref 17-9)	
The Habitats Directive and Birds Directive are transposed into UK law through the Conservation of Habitats and Species Regulations 2017 as amended, known as the "Habitats Regulations"[2]. The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European Sites. The Regulations also require the compilation and maintenance of a register of European sites, to include Special Areas of Conservation ("SACs") (classified under the Habitats Directive) and Special Protection Areas ("SPAs") (classified under the Birds Directive). These sites form the Natura 2000 network. These regulations also apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), candidate SACs ("cSAC"), potential Special Protection Areas ("pSPA"), and proposed and existing European offshore marine sites.	**Section 17.6** characterises the baseline for water and sediment quality. A consideration of impacts on these receptors is described in **Section 17.8** which has informed the assessment of impacts on protected habitats and species presented in **Chapter 9: Nature Conservation (Marine Ecology)** and **Chapter 10: Ornithology [TR030008/APP/6.2]**. A **shadow Habitats Regulations Assessment** report has been produced **[TR030008/APP/7.6].** This report will aid the Competent Authorities[3] in determining whether the Project has the potential for a likely significant effect ("LSE") on the interest features and/or supporting habitat of a European/Ramsar site either alone or in-combination with other plans, projects and activities and, if so, provides information to support the Appropriate Assessment of the implications of the Project on the integrity of the protected site in light of the site's conservation objectives.
National Policy Statement for Ports ("NPSfP") (Ref 17-10)	
The NPSfP provides the policy framework for nationally significant infrastructure projects involving new port development (Ref 17-10). In	This chapter on marine water and sediment quality has been prepared for the ES. A consideration of

[2] Following the UK leaving the EU, the Conservation of Habitats and Species Regulations 2017 (Ref 17-9) have been modified by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ref 17-32).

[3] The Secretary of State is the Competent Authority for the HRA for this Project.

Legislation/Policy/Guidance	Consideration within the ES
order to meet the requirements of the Government's policies on sustainable development, the NPSfP requires that new port infrastructure should also, amongst other things, assess the impact on the water environment, including transitional and coastal waters. Section 5.6 of the NPSfP advises that applicants should assess the existing status and impacts of the Project on water quality, water resources and physical characteristics of the water environment as part of the ES. The ES should describe: • The existing quality of waters affected by the Project and the impacts of the Project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; • Existing water resources affected by the Project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates; • Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the Project and any impact of physical modifications to these characteristics; • Any impacts of the Project on water bodies or protected areas under the WFD and source protection zones ("SPZs") around potable groundwater abstractions; and • Any cumulative effects.	impacts to marine water and sediment quality are presented in **Section 17.8**. The mitigation measures that are proposed to be implemented as standard good practice to manage water quality impacts are presented in **Section 17.7**. An **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.5]** has been prepared and provided with the Development Consent Order ("DCO") application which sets out the mitigation measures considered necessary to manage environmental effects. A consideration of surface water discharges is presented in **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**. A consideration of groundwater and surface water abstractions is presented in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**. A consideration of the physical characteristics of the water environment is presented in **Chapter 16: Physical Processes [TR030008/APP/6.2]**. A consideration of impacts on WFD water bodies is provided in **Section 17.8**. This has also been assessed in the WFD Compliance Assessment submitted with the DCO application (**Appendix 17.A [TR030008/APP/6.4]**). An assessment of any cumulative water and sediment quality effects that could arise from the Project alone, as well as through other plans, projects and ongoing activities within the study area is considered in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.
UK Marine Policy Statement ("MPS") (Ref 17-11)	
The MPS (Ref 17-11) is the framework for preparing marine plans and taking decisions affecting the marine environment. The MPS also sets out the general environmental, social, and economic considerations that need to be taken into account in marine planning and provides guidance on the pressures and impacts that decision makers need to consider when planning for and consenting development in the UK marine areas. Section 2.6.4 of the MPS is relevant to the Marine Water and Sediment Quality assessment. In	This chapter on marine water and sediment quality has been prepared for the ES. A consideration of impacts to marine water and sediment quality is presented in **Section 17.8**. A WFD Compliance Assessment has been undertaken to determine whether the Project complies with the objectives of the WFD (**Appendix 17.A [TR030008/APP/6.4]**).

Legislation/Policy/Guidance	Consideration within the ES
particular, paragraph 2.6.4.3 states, amongst other things, that - "*The marine plan authority should satisfy itself where relevant that any development will not cause a deterioration in status of any water to which the WFD applies... Decision makers should also take into account impacts on the quality of designated bathing waters and shellfish waters from any proposed development.*"	
UK Marine Strategy (Ref 17-12)	
The aim of the UK Marine Strategy is to protect the UK's marine environment. The Strategy sets out a comprehensive framework for assessing, monitoring, and taking action to achieve the UK's shared vision for clean, healthy, safe, productive, and biologically diverse seas (Ref 17-13). It aims to achieve good environmental status of marine waters by 2020 (followed by a six-year review) and then to protect the resource base upon which marine-related economic and social activities depend. The Strategy constitutes a vital environmental component of future maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment. The UK Marine Strategy applies to the landward boundary of coastal waters as defined under the WFD (i.e., from mean high water springs to the outer limit of the UK Exclusive Economic Zone ("EEZ"), as well as the area of UK continental shelf beyond the EEZ. Government reporting against the Strategy is a cyclical process, and the most recent assessments and Marine Strategy documents were updated in 2019.	The Project is not located within a UK Marine Strategy region (it lies within the Lower Humber WFD transitional (estuarine) water body). The anticipated pressures exerted on the marine environment by the Project are considered to be of small magnitude in the context of UK Marine Regions such that they are unlikely to be a significant issue. The Strategy is, therefore, not considered further in this ES with regards to the Marine Water and Sediment Quality assessment.
East Inshore and East Offshore Marine Plans (Ref 17-14)	
The first Marine Plans include the East Inshore and East Offshore Marine Plans, which are collectively referred to as 'the East Marine Plans'. These were formally adopted on 2 April 2014 (Ref 17-14). There is one policy within the East Marine Plans specifically related to water and sediment quality: Policy ECO2 - "*The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation":*	The potential risk of vessel collisions as a result of the Project are considered in **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**. The risks, consequences and mitigation measures relating to potential accidental release of hazardous substances is presented in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**. The impacts of the Project on Marine Water and Sediment Quality are assessed in **Section 17.8** of this chapter. **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** also provides an assessment of the impacts to marine

Legislation/Policy/Guidance	Consideration within the ES
There are also several references to the importance of water quality in supporting a healthy ecosystem and the potential for pollutants to affect the environment as well as people (from marine as well as riverine and terrestrial sources).	habitats and species due to changes in water and sediment quality. A consideration of surface water discharges is presented in **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.
North East Lincolnshire Local Plan 2013 to 2032 (Ref 17-15)	
The North East Lincolnshire Local Plan was adopted in 2018 and covers the period 2013 to 2032. Within its Spatial Portrait, the Local Plan highlights the importance of the 'Estuary Zone' of the local authority area, which includes the 'nationally important port' of Immingham. When considering the detail of how the economy of the area will be developed, the Plan specifically identifies at the outset that there are good expectations of growth within the ports and logistics sector. On the policies map which accompanies the Local Plan, the Site is shown as being located within an area identified as 'Employment – Operational Port'. In addition, Policy 34 of the plan makes clear that: *"Water management* *1. Development proposals that have the potential to impact on surface and ground water should consider the objectives and programme of measures set out in the Humber River Basin Management Plan."* The Humber River Basin Management Plan provides a framework for protecting and enhancing the benefits provided by the water environment within the Humber River Basin District and informs decisions on land-use planning. The Humber River Basin District covers an area of 26,100 km² and extends from the West Midlands in the south, northwards to North Yorkshire and from Staffordshire in the west to part of Lincolnshire and the Humber Estuary in the east	The Project is located largely within the administrative area of North East Lincolnshire, although elements of the marine infrastructure fall beyond the local Council's administrative boundary. A consideration of impacts on WFD water bodies is provided in **Section 17.8**. This has also been assessed in the WFD Compliance Assessment submitted with the DCO application which considers WFD objectives as outlined in the Humber River Basin Management Plan (**Appendix 17.A [TR030008/APP/6.4]**).
Clearing the Waters for All (Ref 17-16)	
In 2016, the Environment Agency published guidance, referred to as "Clearing the Waters for All", regarding how to assess the impact of activities in WFD transitional and coastal water bodies (Ref 17-16). The guidance sets out the	The WFD Compliance Assessment for the Project (**Appendix 17.A [TR030008/APP/6.4]**) follows the format specified in this guidance.

Legislation/Policy/Guidance	Consideration within the ES
following three discrete stages for WFD compliance assessments to follow: Screening: excludes any activities that do not need to go through the scoping or impact assessment stages; Scoping: identifies the receptors and quality elements that are potentially at risk from an activity and need further detailed assessment; and Assessment: considers the potential impacts of an activity, identifies ways to avoid/minimise impacts, and indicates if it may cause deterioration or jeopardise the water body achieving good status.	
Planning Inspectorate Advice Note Eighteen: The Water Framework Directive (Ref 17-17)	
Advice Note Eighteen (Ref 17-17) explains the information that the Inspectorate considers an applicant must provide with their NSIP application in order to clearly demonstrate that the WFD and the Water Environment (WFD) (England and Wales) Regulations 2017 have been appropriately considered. The Advice Note also refers to Environment Agency guidance (as described above) in terms of the WFD process and the information required. Furthermore, the guidance describes the relevant bodies to be consulted in the pre-application process, and the presentation of information.	The WFD Compliance Assessment for the Project (**Appendix 17.A [TR030008/APP/6.4]**) contains the information specified in this guidance as appropriate.

17.4 Assessment Methodology

17.4.1 The overall assessment approach is described in detail in **Chapter 5: EIA Approach [TR030008/APP/6.2]** including definitions of sensitivity/importance of receptors and magnitude of change. This method has been followed for this chapter.

Data and Information Sources

17.4.2 Current baseline conditions have been determined by a desk-based review of available information. A project-specific sediment contamination survey has also been undertaken.

17.4.3 The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the Project include:

a. 'Catchment Data Explorer' website (Ref 17-18).

b. Water body summary table within the Environment Agency (Ref 17-16) 'Clearing the Waters for All' guidance.

c. Multi-Agency Geographic Information for the Countryside ("MAGIC") website (Ref 17-34).

d. 'Find a bathing water' website (Ref 17-19).

e. List of Shellfish Water Protected Areas in England (Ref 17-20).

f. 'Check for Drinking Water Safeguard Zones and NVZs' website (Ref 17-21).

g. 'Water Quality Archive' website (Ref 17-23).

h. Historic marine surface sediment samples (2001) collected in the area of Immingham Outer Harbour for Particle Size Analysis ("PSA") and chemical contamination analysis.

17.4.4 A sediment contamination survey was undertaken in March 2023 to characterise the dredge material and to support the application to dispose of the dredge material at an existing licensed disposal site. This was undertaken in accordance with the Marine Management Organisation ("MMO") sample plan (SAM/2022/00106) which confirmed the suite of contaminants, number of samples, sample locations, replicates and sampling depth required, taking account of available guidelines for the management of dredge material to be disposed at sea (Ref 17-35).

17.4.5 Contaminant concentrations in sediment samples have been compared to Cefas Guideline Action Levels ("ALs") to determine their suitability for disposal at sea. Where these do not exist for a contaminant, consideration has also been given to other comparable tools such as the Canadian Sediment Quality Guidelines ("CSQGs") or proposed Cefas ALs (Ref 17-33) (it should be noted, however, that proposed updates to Cefas ALs are still subject to review and are not yet implemented). Contaminant concentrations in sediments have informed the assessment of potential changes to dissolved concentrations in the water column and predicted potential redistribution of contaminants as a result of the Project.

Limitations and Assumptions

17.4.6 The information presented in this assessment reflects the proposed parameters and design for the Project as described in **Chapter 2: The Project [TR030008/APP/6.2]**.

17.4.7 This assessment has been undertaken based on the following assumptions:

a. Capital dredging is undertaken by backhoe dredger (e.g., Mannu Pekka or similar) with disposal at the Clay Huts disposal site (HU060) or the Holme Channel (HU056) disposal site. Maintenance dredging (if required at all) is undertaken by Trailing Suction Hopper Dredger with disposal at the Clay Huts disposal site (HU060).

b. Assessment of sediment release rates are based on modelling outputs presented in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

c. The SeDiChem tool outputs based on a number of simple assumptions, namely general site parameters (e.g., net flow rate of 20,736,000m³/day based on an average for the Humber of 240m³/second (Ref 17-36)), maximum incremental Suspended Sediment Concentration ("SSC") (800mg/l), worst case (or precautionary) partition coefficients from suggested literature and sediment quality from samples collected within the proposed dredge area.

17.4.8 The assessment within this chapter has been undertaken considering the anticipated worst-case scenario in respect of water and sediment quality receptors at the dredge, piling and disposal locations.

17.5 Study Area

17.5.1 The study area for this assessment is the area over which potential direct and indirect effects of the Project are predicted to occur during the construction and operational periods. The direct effects on water and sediment quality are those that may arise due to accidental releases during construction or disturbance of sediments into the water column and increases in turbidity. Indirect effects are those that may arise due to sediment that is disturbed and released into the water column during the marine works resulting in changes in water quality through changes in the levels of dissolved oxygen or the release of sediment-bound contaminants.

17.5.2 The study area for the water and sediment quality topic is considered to be the Site and the adjacent Immingham coastline, the existing jetties across the near-field and the central part of the Humber Estuary, generally between Sunk Chanel and Halton Middle. Within the far-field region, the study area includes the wider Humber Estuary from the mouth up to estuary of the Hull Bend. This reflects the same study area for **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

17.6 Baseline Conditions

Current Baseline

Water quality

Water Framework Directive

17.6.1 Water quality standards and objectives are implemented through a range of legislation including the Water Framework Regulations, the Bathing Water Regulations, and the UK Marine Strategy (see **Table 17-2**). The standards and objectives were established through the WFD which provided for holistic management of all water bodies including rivers, estuaries, groundwater, lakes, and coastal waters to 1nm offshore. Domestic legislation derived from the WFD integrates and requires protection of designated shellfish waters, through The Water Framework Regulations; bathing waters, through the Bathing Water Regulations; nature conservation sites, through the Habitats Regulations; and eutrophication, through the Nitrate Pollution Prevention Regulations.

17.6.2 The Environment Agency published River Basin Management Plans ("RBMPs"), which set out measures through which compliance with WFD objectives will be achieved. The Humber River Basin District RBMP identifies the Humber Lower water body (ID: GB530402609201) within and surrounding the Project (including Humber Estuary disposal sites) (Ref 17-18) (**Figure 17.1 [TR030008/APP/6.3]**). It is recorded as a heavily modified water body due to coastal protection use, flood protection use, and navigation use. This means 'ecological potential' is applied rather than 'ecological status'. The current (2022) status of this waterbody is an ecological potential of 'moderate'. The chemical status in 2022 was noted as 'does not require assessment', however, in 2019 the water body had a chemical status of 'fail'. The reason for the 'fail' chemical status (in 2019) was based on priority substances cypermethrin and dichlorvos, and priority hazardous substances polybrominated diphenyl ethers ("PBDE"), perfluorooctane sulphonate ("PFOS"), benzo(a)pyrene, benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds, and tributyltin compounds. The source of contaminants is not known but may relate to historical industrial and maritime activities on the Humber. Surface water bodies overlapping the landside works are detailed in **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage** and **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**.

Bathing Waters

17.6.3 Cleethorpes designated bathing waters is located approximately 11.5km south east of the Project, and Humberston Fitties is located approximately 15km south east (**Figure 17.2 [TR030008/APP/6.3]**). Cleethorpes was assessed as having 'good' bathing water quality in 2022 (Ref 17-19), declining from an 'excellent' classification in 2019. Humberston Fitties was assessed as having 'good' bathing water quality in 2022 (Ref 17-19), remaining consistent with a 'good' classification in 2019.

Shellfish Water Protected Areas

17.6.4 There are no Shellfish Water Protected Areas in the vicinity of the Project (Ref 17-20). The nearest is the West Wash Shellfish Water Protected Area, located over 65km south.

Nitrate Vulnerable Zones ("NVZ")

17.6.5 As the NVZ is landside this is considered in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**. NVZs have also been considered in the WFD Compliance Assessment (**Appendix 17.A [TR030008/APP/6.4]**).

Sensitive Areas

17.6.6 There are no sensitive areas designated under the Urban Waste Water Treatment Regulations in the vicinity of the Site (Ref 17-22).

17.6.7 The main watercourses in the vicinity of the Site (within 5km) are South Killingholme Haven which drains to the north-west corner of the Port of Immingham (but is defined as part of the Humber Estuary water body), North Killingholme main drain, Habrough Marsh drain and the Humber Estuary itself.

Water quality monitoring

17.6.8 The Environment Agency's 'Water Quality Archive' (Ref 17-23) provides data on water quality measurements taken at sampling points around England. These can be from coastal or estuarine waters, rivers, lakes, ponds, canals or groundwaters. They are taken for a number of purposes including compliance assessment against discharge permits, investigation of pollution incidents or environmental monitoring.

17.6.9 The nearest saline water sampling point to the Project (with adequate temporal coverage and a reasonable amount of determinands measured) is Clean Site - Ti02 Monitoring Point, 1985 (sampling ID: AN-CLNMON1). This is shown on **Figure 17.3 [TR030008/APP/6.3]**. Contaminant concentrations measured in the water at this location are shown in **Table 17-3**:. These are compared against Environmental Quality Standards ("EQS") as described under the WFD (Standards and Classification) Directions (England and Wales) 2015, specifically annual average AA concentrations and/or MAC to provide an indication of the water quality measured at the sampling point.

17.6.10 As indicated below in **Table 17-3**:, metal concentrations reported between 2015 and 2023 were typically below respective EQSs. There were some exceedances related to the AA EQS for tributyl tin ("TBT") and the Humber Estuary transitional water body was failing chemical status due to excessive concentrations of TBT in 2019. Benzo(a)pyrene and benzo(g,h,i)perylene were failing their respective MAC EQSs between 2015 and 2023 (with the exception of 2022 for benzo(a)pyrene). Benzo(b)fluoranthene and benzo(k)fluoranthene were also failing their MAC EQSs in 2015 to 2023 (with the exception 2019). The Humber Lower transitional water body was failing chemical status due to benzo(a)pyrene, benzo(b)fluoranthene and benzo(g-h-i)perylene in 2019.

Table 17-3: Concentration range, mean and number of water samples collected between 2015 and 2023 by the Environment Agency for contaminants measured near the Project

Parameter	Unit	EQS	Results	2015	2016	2017	2018	2019	2020	2021	2022	2023
Arsenic	µg/l	25 (AA)	Range	1.9 - 2.39	2.32 - 2.32	-	1.94 - 2.59	1.95 - 1.95	-	-	-	2.2 - 2.2
			Average	2.10	2.32		2.28	1.95				2.20
			n	3	1		3	1				1
Cadmium	µg/l	0.2 (AA)	Range	0.044 - 0.101	0.041 - 0.066	0.062 - 0.063	0.0461 - 0.144	0.0408 - 0.0706	-	0.058 - 0.12	0.051 - 0.08	0.045 - 0.081
			Average	0.08	0.05	0.06	0.09	0.06		0.08	0.07	0.06
			n	9	4	2	9	3		8	12	4
Chromium (VI)	µg/l	0.6 (AA); 32 (MAC)	Range	<0.3	<0.3	-	<0.3	<0.3	-	-	-	-
			Average	0.3	0.3		0.3	0.3				
			n	1	1		3	1				
Copper	µg/l	3.76 (AA)	Range	1.7 - 2.62	2.5 - 3.2	2.35 - 2.96	1.99 - 2.52	1.59 - 1.59	-	1.7 - 3.2	1.7 - 3.7	1.8 - 4.2
			Average	2.01	2.85	2.66	2.20	1.59		2.19	2.28	2.93
			n	3	2	2	3	1		8	12	4
Lead	µg/l	1.3 (AA); 14 (MAC)	Range	<0.04 - 0.074	0.04 - 0.098	-	<0.04 - 0.0876	0.0656 - 0.108	-	0.046 - 0.12	<0.04 - 0.088	0.054 - 0.09
			Average	0.06	0.07		0.05	0.08		0.07	0.07	0.08
			n	9	3		9	3		8	12	4
Mercury	µg/l	0.07 (MAC)	Range	<0.01 - 0.01	<0.01 - 0.01	-	<0.01 - 0.01	<0.01 - 0.01	-	-	-	0.013 - 0.013
			Average	0.01	0.01		0.01	0.01				0.013
			n	9	3		9	3				1
Nickel	µg/l	8.6 (AA); 34 (MAC)	Range	1.25 - 2.29	1.14 - 2.11	1.79 - 2.11	1.4 - 2.48	1.35 - 1.8	-	1.4 - 7.8	1.3 - 7.2	1.3 - 2

Parameter	Unit	EQS	Results	2015	2016	2017	2018	2019	2020	2021	2022	2023
			Average	1.69	1.61	1.95	1.80	1.54		2.43	2.05	1.73
			n	9	4	2	9	3		8	12	4
Zinc	µg/l	7.9 (AA)	Range	2.2 - 4.7	3.47 - 4.86	4.22 - 4.86	2.21 - 4.32	4.05 - 4.05	-	1.9 - 5.7	1.9 - 4.6	3 - 4.1
			Average	3.79	4.17	4.54	3.15	4.05		3.29	3.16	3.68
			n	3	2	2	3	1		8	12	4
Tributyltin (TBT)	µg/l	0.0002 (AA); 0.0015 (MAC)	Range	0.00021 - 0.00096	<0.0002 - 0.0008	0.00029 - 0.00092	<0.0002 - 0.00081	0.00025 - 0.00032	-	<0.0002 - 0.00023	<0.0002 - 0.00042	<0.0002 - 0.00026
			Average	0.0004	0.0004	0.0005	0.0003	0.0003		0.0002	0.0003	0.0002
			n	9	12	3	10	2		8	12	4
Benzo(a)-pyrene	µg/l	0.00017 (AA); 0.0027 (MAC)	Range	>0.002 - <0.01	>0.002 - 0.22	0.00055 - >0.05	<0.0004 - 0.0874	0.0146 - 0.017	-	<0.0004 - 0.033	<0.0004 - 0.026	0.00077 - >0.05
			Average	0.01	0.04	0.03	0.03	0.02		0.01	0.01	0.02
			n	12	12	3	8	3		8	12	4
Benzo(g,h,i)-perylene	µg/l	0.00082 (MAC)	Range	>0.002 - <0.01	0.002 - 0.239	0.00063 - 0.05	0.00057 - 0.0911	0.0149 - 0.0183	-	0.0004 - 0.03	<0.0004 - 0.024	0.00054 - >0.05
			Average	0.01	0.04	0.02	0.03	0.02		0.01	0.01	0.02
			n	12	12	3	8	2		8	12	4
Benzo(b)-fluoranthene	µg/l	0.017 (MAC)	Range	>0.002 - <0.01	>0.002 - 0.196	0.00056 - >0.05	0.00045 - 0.0743	0.013 - 0.0139	-	0.00052 - 0.03	<0.0004 - 0.021	0.00071 - 0.048
			Average	0.01	0.04	0.02	0.03	0.01		0.01	0.01	0.02
			n	12	12	3	8	2		8	12	4
Benzo(k)-fluoranthene	µg/l	0.0063 (AA);	Range	>0.002 - <0.01	>0.002 - 0.111	<0.0004 - >0.05	0.0004 - 0.0379	0.00701 - 0.00746	-	<0.0004 - 0.016	<0.0004 - 0.012	<0.0004 - 0.028

Parameter	Unit	EQS	Results	2015	2016	2017	2018	2019	2020	2021	2022	2023
		0.017 (MAC)	Average	0.01	0.02	0.02	0.01	0.01		0.01	0.00	0.01
			n	12	12	3	8	2		8	12	4
Fluoranthene	µg/l	0.12 (MAC)	Range	>0.002 - <0.01	>0.002 - 0.142	0.00103 - >0.05	<0.0004 - 0.0953	0.0163 - 0.0185	-	0.0015 - 0.026	0.0012 - 0.023	0.0015 - 0.03
			Average	0.01	0.04	0.03	0.03	0.02		0.01	0.01	0.02
			n	12	12	3	8	3		8	12	4
Hexa-chlorobenzene	µg/l	0.05 (MAC)	Range	<0.001 - 0.001	<0.0001 - 0.001	<0.0001 - 0.005	-	-	-	-	-	-
			Average	0.001	0.0005	0.002						
			n	12	7	3						
Hexa-chlorobutadiene	µg/l	0.6 (MAC)	Range	<0.003 - 0.003	<0.0001 - <0.003	<0.0001 - <0.005	-	-	-	-	-	-
			Average	0.003	0.001	0.002						
			n	12	7	3						
BDE 28	µg/l	-	Range	<0.00006 - <0.00006	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.00006	0.00006	0.00006						
			n	7	7	3						
BDE 47	µg/l	-	Range	<0.00006 - 0.0001	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.0001	0.00006	0.00006						
			n	7	7	3						

Parameter	Unit	EQS	Results	2015	2016	2017	2018	2019	2020	2021	2022	2023
BDE 99	µg/l	-	Range	<0.00006 - 0.00017	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.0001	0.00006	0.00006						
			n	7	7	3						
BDE 100	µg/l	-	Range	<0.00006 - 0.00017	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.0001	0.00006	0.00006						
			n	7	7	3						
BDE 153	µg/l	-	Range	<0.00006 - 0.00007	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.0001	0.00006	0.00006						
			n	7	7	3						
BDE 154	µg/l	-	Range	<0.00006 - <0.00006	<0.00006 - <0.00006	<0.00006 - <0.00006	-	-	-	-	-	-
			Average	0.00006	0.00006	0.00006						
			n	7	7	3						
Data from sampling point 'Clean Site - Ti02 Monitoring Point, 1985, ID: AN-CLNMON1)' in the Humber Estuary, obtained from the Environment Agency's 'Water Quality Archive' (Ref 17-23)												

Sediment quality

17.6.11 The UK has not adopted formal quantitative EQS for sediments. In the absence of any quantified UK standards, therefore, common practice for characterising baseline sediment quality conditions is to compare against the Cefas Guideline Action Levels for the disposal of dredged material (Ref 17-24).

17.6.12 Cefas Guideline Action Levels are used as part of a 'weight of evidence' approach to assessing material suitability for disposal at sea. Cefas guidance indicates that, in general, contaminant levels below Action Level 1 ("AL1") are of no concern. Material with contaminant levels above Action Level 2 ("AL2"), however, is generally considered unsuitable for disposal at sea whilst dredged material with contaminant levels between AL1 and AL2 requires further consideration before a decision can be made as to disposal. Consequently, the Action Levels should not be viewed as pass/fail thresholds, and it is also recognised that these guidelines are not statutory requirements. Cefas Action Levels are not available for every contaminant and where appropriate comparisons may be made to other alternative guidance levels, e.g. Canadian Sediment Quality Guidelines or thresholds from other European/OSPAR[4] nations, to provide context. It is also noted that Action Levels in the UK are currently being reviewed but have yet to be formally adopted (Ref 17-25).

17.6.13 In February 2023, a sample plan (SAM/2022/00106) was provided by the MMO, prepared in consultation with Cefas. In March 2023, sediment samples were collected from eight stations (1 to 8) across the proposed dredge area comprising the Project, including subsurface samples (**Figure 17.3 [TR030008/APP/6.3]**).

17.6.14 The sampling regime and analysis was undertaken in accordance with the sample plan. The sediment samples were analysed by an MMO-approved laboratory for the following physical and chemical parameters:

a. Particle size analysis ("PSA")
b. Trace metals
c. Organotins
d. Polycyclic aromatic hydrocarbons ("PAHs")
e. Polychlorinated biphenyls ("PCBs")
f. Total hydrocarbon content ("THC")
g. Organochlorine pesticides ("OCPs")

17.6.15 The PSA results are presented in **Table 17-4**. Sediments from most sampling locations were dominated by silt material with limited amounts of gravel. Samples from Sample 1 (1m), Sample 2 (2m), and Sample 3 (1m) were predominantly comprised of sand. Sample 2 (0m), Sample 7 (0m), and Sample 8 (0m and 2.9m) were predominantly comprised of gravel.

[4] Countries signed up to the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic.

17.6.16 Sediment samples have also been analysed for total organic carbon ("TOC") (**Table 17-4**). Values typically ranged from about 0.5% to 2%, with a minimum of 0.17% and a maximum of 6.36%. The average organic carbon content across all samples was 1.31%. Generally, samples with higher proportions of sand and gravel had lower TOC as organic matter tends to accumulate in finer grained sediments.

17.6.17 A summary of sediment quality (chemical analysis) of samples from the dredge area is provided in **Table 17-5**: to

17.6.18 **Table 17-12**: concentrations above or below Cefas Guideline Action Levels are highlighted to provide an indication of sediment quality (comparisons to other thresholds are noted below where these do not exist). Contaminant concentrations were generally low, with most values below the respective Cefas Guideline AL1 or marginally exceeding AL1. There were no instances where the concentration exceeded the respective AL2 (or a sample concentration was close to exceeding this threshold).

17.6.19 Trace metal concentrations were typically below AL1 in most samples, with some minor exceedances of AL1 for some metals (mainly in Samples 4, 5 and 6). Most individual PAHs were found to be below AL1, though some samples exceeded AL1, particularly in Samples 4, 5 and 6. There is currently no AL2 for individual or total PAHs. Cefas and Defra are proposing to introduce updated ALs for these contaminants, however, these proposed ALs are still subject to review and are not yet implemented. Nevertheless, at the request of the MMO, PAH concentrations have been compared against the proposed Cefas ALs for the sum of low molecular weight ("LMW") and high molecular weight ("HMW") PAHs. Most samples were also below the proposed AL1, though again some exceeded the proposed AL1 (again in Vibrocores 4, 5 and 6). None exceeded the proposed AL2 for PAHs. The CSQGs define a Probable Effect Level ("PEL") concentration (considered the concentration which adverse effects frequently occur) for benzo(a)pyrene (763 µg/kg) and fluoranthene (1494 µg/kg); all samples were below these concentrations.

17.6.20 PCB concentrations were low, mostly below the Limit of Detection ("LOD"), and both the sum of ICES 7 and the sum of 25 congeners were below AL1 for all samples. OCP concentrations were also often below the LOD in most samples; dieldrin concentrations were below AL1 in all samples, and p,p'-Dichlorodiphenyltrichloroethane ("DDT") concentrations were predominantly below AL1 in most samples, with some minor exceedances of AL1.

Table 17-4: Particle size analysis (PSA) results from sediment samples collected in March 2023

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2mm)	Sand (2mm – 63 µm)	Silt (<63 µm)
Sample 1	0	Odourless Brown Mud with Organic Matter.	6.07	0.39	16.25	83.36
Sample 1	1	Odourless Brown Gravelly Sandy Mud with Organic Matter.	0.85	1.91	52.30	45.79
Sample 1	2.2	Odourless Brown Gravelly Mud.	1.02	8.26	14.19	77.55
Sample 2	0	Odourless Brown Gravelly Sandy Mud with Shell Fragments.	0.79	49.45	8.79	41.76
Sample 2	1	Odourless Brown Gravelly Mud.	0.98	6.96	15.49	77.56
Sample 2	2	Odourless Brown Gravelly Muddy Sand.	0.17	2.58	61.59	35.83
Sample 2	2.95	Odourless Brown Sandy Mud.	0.59	0.00	21.59	78.41
Sample 3	0	Brown Mud with Organic Matter and a Peat Odour.	6.36	0.00	37.51	62.49
Sample 3	1	Odourless Brown Muddy Sand.	0.56	0.00	60.13	39.87
Sample 3	2	Odourless Brown Gravelly Mud.	1.05	10.46	10.71	78.84
Sample 3	2.5	Odourless Brown Gravelly Mud.	0.97	11.93	12.58	75.48
Sample 4	0	Odourless Brown Sandy Mud.	1.44	0.00	20.09	79.91

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2mm)	Sand (2mm – 63 µm)	Silt (<63 µm)
Sample 4	1	Odourless Brown Mud.	1.60	0.00	17.23	82.77
Sample 4	2	Odourless Brown Mud.	2.01	0.00	15.53	84.47
Sample 4	3	Odourless Brown Sandy Mud.	2.22	0.00	40.04	59.96
Sample 4	4	Odourless Brown Mud.	0.93	0.00	0.00	100.00
Sample 5	0	Odourless Brown Mud.	1.39	0.00	20.27	79.73
Sample 5	1	Odourless Brown Sandy Mud.	0.86	0.00	32.08	67.92
Sample 5	2	Odourless Brown Mud.	1.55	0.00	24.55	75.45
Sample 5	3	Odourless Brown Sandy Mud.	1.13	0.00	2.23	97.77
Sample 5	4	Odourless Brown Gravelly Sandy Mud.	0.71	9.57	5.38	85.05
Sample 6	0	Odourless Brown Mud.	1.68	0.00	13.94	86.06
Sample 6	1	Brown Mud with a Peat Odour.	1.50	0.00	13.34	86.66
Sample 6	2	Brown Sandy Mud with a Peat Odour.	0.79	0.00	37.24	62.76
Sample 6	3	Odourless Brown Gravelly Mud.	0.79	4.87	5.84	89.29
Sample 6	4	Odourless Brown Sandy Mud.	0.94	0.00	0.00	100.00

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2mm)	Sand (2mm – 63 µm)	Silt (<63 µm)
Sample 7	0	Odourless Brown Muddy Gravel.	0.41	80.07	11.06	8.87
Sample 7	1	Odourless Brown Sandy Mud.	0.59	0.00	1.76	98.24
Sample 7	1.4	Odourless Brown-White Gravelly Mud.	0.33	20.20	8.42	71.37
Sample 8	0	Odourless White Muddy Gravel.	1.11	47.44	6.16	46.40
Sample 8	1	Odourless Brown Gravelly Mud.	0.85	5.98	2.36	91.66
Sample 8	2	Odourless Brown Gravelly Mud.	0.46	4.20	10.72	85.09
Sample 8	2.9	Odourless Other Muddy Gravel.	0.39	72.45	4.46	23.09

Table 17-5: Sediment contamination data for Sample 1 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 1 (0m)	Sample 1 (1.0m)	Sample 1 (2.2m)
Arsenic	mg/kg	20	100	12.3	9.4	9.6
Cadmium	mg/kg	0.4	5	0.59	0.05	0.12
Chromium	mg/kg	40	400	36.8	7.80	21.8
Copper	mg/kg	40	400	23.4	5.90	16.9
Lead	mg/kg	50	500	20.4	5.40	11.2
Mercury	mg/kg	0.3	3	0.06	0.04	0.03
Nickel	mg/kg	20	200	43.9	6.40	26.9
Zinc	mg/kg	130	800	143	38.4	48.1
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001
Acenaphthene	µg/kg	100	-	<5	<5	5.0
Acenaphthylene	µg/kg	100	-	<5	<5	2.3
Anthracene	µg/kg	100	-	<5	<5	7.0

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 1 (0m)	Sample 1 (1.0m)	Sample 1 (2.2m)
Benzo[a]anthracene	µg/kg	100	-	17.1	<5	24.9
Benzo[a]pyrene	µg/kg	100	-	23.3	<5	34.1
Benzo[b]fluoranthene	µg/kg	100	-	34.4	<5	35.8
Benzo[e]pyrene	µg/kg	100	-	58.4	<5	56.9
Benzo[ghi]perylene	µg/kg	100	-	62.2	<5	80.7
Benzo[k]fluoranthene	µg/kg	100	-	23.9	<5	19.5
C1-naphthalenes	µg/kg	100	-	190.0	<5	132.0
C1-phenanthrene	µg/kg	100	-	163.0	7.5	159.0
C2-naphthalenes	µg/kg	100	-	183.0	<5	141.0
C3-naphthalenes	µg/kg	100	-	123.0	<5	150.0
Chrysene	µg/kg	100	-	51.1	<5	51.5
Dibenzo[ah]anthracene	µg/kg	100	-	<5	<5	5.2
Fluoranthene	µg/kg	100	-	35.2	<5	42.9
Fluorene	µg/kg	100	-	28.7	<5	11.9

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 1 (0m)	Sample 1 (1.0m)	Sample 1 (2.2m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	14.4	<5	19.1
Naphthalene	µg/kg	100	-	48.6	<5	23.8
Perylene	µg/kg	100	-	869.0	5160.0	14.5
Phenanthrene	µg/kg	100	-	141.0	6.2	108.0
Pyrene	µg/kg	100	-	44.4	<5	60.6
Total Hydrocarbon Content (THC)	mg/kg	-	-	6.09	4.11	24.8
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00056	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.002	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0002	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 1 (0m)	Sample 1 (1.0m)	Sample 1 (2.2m)
PPTDE	mg/kg	-	-	0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0018	<0.0001	<0.0001
Key	Below AL1					
	Above AL1, Below AL2					
	Above AL2					

Table 17-6: Sediment contamination data for Sample 2 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 2 (0m)	Sample 2 (1.0m)	Sample 2 (2.0m)	Sample 2 (2.95m)
Arsenic	mg/kg	20	100	11.2	11.5	3.5	3.9
Cadmium	mg/kg	0.4	5	<0.04	0.11	<0.04	<0.04
Chromium	mg/kg	40	400	22.8	21.3	6.60	9.40
Copper	mg/kg	40	400	15.8	14.1	7.60	9.60
Lead	mg/kg	50	500	14.3	9.80	3.60	5.10
Mercury	mg/kg	0.3	3	0.05	0.02	0.01	0.03
Nickel	mg/kg	20	200	23.3	25.2	8.10	11.2
Zinc	mg/kg	130	800	96.0	53.6	18.0	24.2
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Acenaphthene	µg/kg	100	-	14.0	8.1	1.7	20.8
Acenaphthylene	µg/kg	100	-	7.0	2.3	<1	6.9
Anthracene	µg/kg	100	-	19.2	11.3	1.9	26.0

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 2 (0m)	Sample 2 (1.0m)	Sample 2 (2.0m)	Sample 2 (2.95m)
Benzo[a]anthracene	µg/kg	100	-	61.4	30.8	6.9	106.0
Benzo[a]pyrene	µg/kg	100	-	79.0	39.6	9.8	100.0
Benzo[b]fluoranthene	µg/kg	100	-	78.6	46.1	8.5	82.2
Benzo[e]pyrene	µg/kg	100	-	89.2	58.6	12.6	113.0
Benzo[ghi]perylene	µg/kg	100	-	128.0	87.7	19.6	134.0
Benzo[k]fluoranthene	µg/kg	100	-	75.5	27.7	6.9	71.3
C1-naphthalenes	µg/kg	100	-	216.0	130.0	28.8	400.0
C1-phenanthrene	µg/kg	100	-	212.0	205.0	38.3	607.0
C2-naphthalenes	µg/kg	100	-	192.0	142.0	34.9	475.0
C3-naphthalenes	µg/kg	100	-	197.0	175.0	46.1	625.0
Chrysene	µg/kg	100	-	87.5	54.1	11.8	153.0
Dibenzo[ah]anthracene	µg/kg	100	-	14.2	7.7	1.7	16.3
Fluoranthene	µg/kg	100	-	101.0	51.2	8.4	139.0
Fluorene	µg/kg	100	-	24.2	22.9	2.7	29.2

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 2 (0m)	Sample 2 (1.0m)	Sample 2 (2.0m)	Sample 2 (2.95m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	57.7	23.4	5.0	44.5
Naphthalene	µg/kg	100	-	60.9	26.0	5.6	80.3
Perylene	µg/kg	100	-	29.6	15.2	2.8	23.1
Phenanthrene	µg/kg	100	-	142.0	122.0	23.1	375.0
Pyrene	µg/kg	100	-	118.0	67.8	16.2	198.0
Total Hydrocarbon Content (THC)	mg/kg	-	-	71.6	15.3	19.1	86.7
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00057	0.00056	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.00201	0.002	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 2 (0m)	Sample 2 (1.0m)	Sample 2 (2.0m)	Sample 2 (2.95m)
PPTDE	mg/kg	-	-	0.0014	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0002	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0002	<0.0001	0.0009	<0.0001
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

Table 17-7: Sediment contamination data for Sample 3 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0m)	Sample 3 (1.0m)	Sample 3 (2.0m)	Sample 3 (2.5m)
Arsenic	mg/kg	20	100	10.2	6.1	10.4	7.3
Cadmium	mg/kg	0.4	5	0.47	<0.04	0.11	0.28
Chromium	mg/kg	40	400	34.5	9.20	20.4	19.6
Copper	mg/kg	40	400	20.3	11.5	18.0	15.4
Lead	mg/kg	50	500	18.0	6.90	12.2	10.4
Mercury	mg/kg	0.3	3	0.04	0.02	0.03	0.02
Nickel	mg/kg	20	200	38.6	17.5	29.4	24.4
Zinc	mg/kg	130	800	130.0	24.1	56.7	41.0
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Acenaphthene	µg/kg	100	-	<5	<5	7.6	15.4
Acenaphthylene	µg/kg	100	-	<5	<5	2.6	2.6
Anthracene	µg/kg	100	-	<5	<5	9.0	6.9

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0m)	Sample 3 (1.0m)	Sample 3 (2.0m)	Sample 3 (2.5m)
Benzo[a]anthracene	µg/kg	100	-	21.6	<5	24.9	24.2
Benzo[a]pyrene	µg/kg	100	-	23.8	<5	29.3	31.6
Benzo[b]fluoranthene	µg/kg	100	-	54.5	12.3	36.6	38.7
Benzo[e]pyrene	µg/kg	100	-	65.1	16.3	53.0	54.2
Benzo[ghi]perylene	µg/kg	100	-	84.6	19.2	77.7	80.0
Benzo[k]fluoranthene	µg/kg	100	-	20.5	<5	21.4	17.8
C1-naphthalenes	µg/kg	100	-	194.0	12.0	111.0	111.0
C1-phenanthrene	µg/kg	100	-	171.0	31.1	162.0	187.0
C2-naphthalenes	µg/kg	100	-	229.0	14.0	125.0	136.0
C3-naphthalenes	µg/kg	100	-	135.0	14.9	140.0	188.0
Chrysene	µg/kg	100	-	56.3	14.8	49.9	49.1
Dibenzo[ah]anthracene	µg/kg	100	-	10.2	<5	7.4	7.7
Fluoranthene	µg/kg	100	-	36.4	9.3	49.6	44.4
Fluorene	µg/kg	100	-	30.3	<5	17.0	27.4

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0m)	Sample 3 (1.0m)	Sample 3 (2.0m)	Sample 3 (2.5m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	23.8	<5	17.7	19.2
Naphthalene	µg/kg	100	-	47.2	<5	18.9	20.8
Perylene	µg/kg	100	-	973.0	<5	12.0	12.3
Phenanthrene	µg/kg	100	-	138.0	20.2	101.0	140.0
Pyrene	µg/kg	100	-	45.1	12.8	63.6	56.8
Total Hydrocarbon Content (THC)	mg/kg	-	-	9.24	16.4	14.5	19.1
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00056	0.00056	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.00201	0.002	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0m)	Sample 3 (1.0m)	Sample 3 (2.0m)	Sample 3 (2.5m)
PPTDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	<0.0001	<0.0001	<0.0001	<0.0001
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

Table 17-8: Sediment contamination data for Sample 4 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 4 (0m)	Sample 4 (1.0m)	Sample 4 (2.0m)	Sample 4 (3.0m)	Sample 4 (4.0m)
Arsenic	mg/kg	20	100	14.8	26.2	31.4	26.8	5.1
Cadmium	mg/kg	0.4	5	0.48	0.57	0.6	0.37	0.25
Chromium	mg/kg	40	400	32.2	49.8	59.2	50.5	22.0
Copper	mg/kg	40	400	21.7	30.2	37.9	32.6	16.4
Lead	mg/kg	50	500	42.0	60.6	75.3	63.1	10.5
Mercury	mg/kg	0.3	3	0.12	0.18	0.25	0.2	0.02
Nickel	mg/kg	20	200	23.1	26.6	31.4	26.6	25.1
Zinc	mg/kg	130	800	103	151	189	160	47.5
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.001	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	0.00828	<0.001	<0.005
Acenaphthene	µg/kg	100	-	9.6	54.5	106.0	<5	7.3
Acenaphthylene	µg/kg	100	-	5.6	35.7	36.2	<5	2.5
Anthracene	µg/kg	100	-	19.6	108.0	137.0	<5	10.9

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 4 (0m)	Sample 4 (1.0m)	Sample 4 (2.0m)	Sample 4 (3.0m)	Sample 4 (4.0m)
Benzo[a]anthracene	µg/kg	100	-	43.9	237.0	263.0	14.4	34.1
Benzo[a]pyrene	µg/kg	100	-	56.6	323.0	336.0	12.8	39.5
Benzo[b]fluoranthene	µg/kg	100	-	52.3	281.0	304.0	14.2	47.2
Benzo[e]pyrene	µg/kg	100	-	44.4	242.0	247.0	17.5	61.4
Benzo[ghi]perylene	µg/kg	100	-	52.2	295.0	292.0	21.2	90.0
Benzo[k]fluoranthene	µg/kg	100	-	48.6	275.0	276.0	10.6	23.3
C1-naphthalenes	µg/kg	100	-	151.0	775.0	814.0	63.2	154.0
C1-phenanthrene	µg/kg	100	-	95.0	461.0	503.0	75.9	179.0
C2-naphthalenes	µg/kg	100	-	123.0	606.0	653.0	65.3	148.0
C3-naphthalenes	µg/kg	100	-	109.0	528.0	584.0	75.4	160.0
Chrysene	µg/kg	100	-	53.1	281.0	307.0	23.3	62.2
Dibenzo[ah]anthracene	µg/kg	100	-	9.1	51.4	52.6	<5	8.9
Fluoranthene	µg/kg	100	-	87.9	503.0	560.0	19.9	59.3
Fluorene	µg/kg	100	-	17.8	101.0	126.0	6.1	21.1

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 4 (0m)	Sample 4 (1.0m)	Sample 4 (2.0m)	Sample 4 (3.0m)	Sample 4 (4.0m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	43.1	257.0	257.0	<5	21.7
Naphthalene	µg/kg	100	-	55.5	295.0	322.0	15.6	31.2
Perylene	µg/kg	100	-	18.9	119.0	136.0	<5	16.8
Phenanthrene	µg/kg	100	-	90.5	443.0	531.0	50.8	121.0
Pyrene	µg/kg	100	-	84.9	474.0	524.0	26.1	87.9
Total Hydrocarbon Content (THC)	mg/kg	-	-	22.5	64.9	49.3	33.5	8.90
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00228	0.00507	0.00707	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.00537	0.01148	0.01538	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	0.0001	0.0003	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0003	0.0008	0.0010	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0004	0.0007	0.0010	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 4 (0m)	Sample 4 (1.0m)	Sample 4 (2.0m)	Sample 4 (3.0m)	Sample 4 (**4.0m**)
PPTDE	mg/kg	-	-	0.0042	0.0070	0.0103	0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0008	0.0017	0.0021	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0002	<0.0001	0.0034	<0.0001	<0.0001
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 17-9: Sediment contamination data for Sample 5 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 5 (0m)	Sample 5 (1.0m)	Sample 5 (2.0m)	Sample 5 (3.0m)	Sample 5 (4.0m)
Arsenic	mg/kg	20	100	15.4	12.4	25.8	7.7	8.6
Cadmium	mg/kg	0.4	5	0.18	0.2	0.57	0.38	0.41
Chromium	mg/kg	40	400	32.4	21.3	46.8	28.0	22.0
Copper	mg/kg	40	400	21.6	14.2	30.0	21.4	19.2
Lead	mg/kg	50	500	41.0	28.4	58.7	16.7	13.3
Mercury	mg/kg	0.3	3	0.12	0.07	0.18	0.01	0.03
Nickel	mg/kg	20	200	22.6	15.2	25.1	33.2	45.5
Zinc	mg/kg	130	800	104	73.0	154	63.7	56.6
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	0.008	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	0.029	<0.001	<0.001
Acenaphthene	µg/kg	100	-	45.7	26.7	155.0	14.1	<5
Acenaphthylene	µg/kg	100	-	25.8	16.3	62.0	<5	<5
Anthracene	µg/kg	100	-	84.7	46.6	215.0	10.3	<5

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 5 (0m)	Sample 5 (1.0m)	Sample 5 (2.0m)	Sample 5 (3.0m)	Sample 5 (4.0m)
Benzo[a]anthracene	µg/kg	100	-	210.0	105.0	424.0	47.9	15.1
Benzo[a]pyrene	µg/kg	100	-	267.0	125.0	507.0	70.3	21.4
Benzo[b]fluoranthene	µg/kg	100	-	242.0	112.0	432.0	104.0	65.5
Benzo[e]pyrene	µg/kg	100	-	206.0	98.9	360.0	168.0	78.2
Benzo[ghi]perylene	µg/kg	100	-	232.0	110.0	395.0	154.0	60.5
Benzo[k]fluoranthene	µg/kg	100	-	209.0	104.0	415.0	37.4	15.7
C1-naphthalenes	µg/kg	100	-	683.0	335.0	1240.0	569.0	236.0
C1-phenanthrene	µg/kg	100	-	454.0	224.0	682.0	387.0	148.0
C2-naphthalenes	µg/kg	100	-	550.0	264.0	988.0	389.0	140.0
C3-naphthalenes	µg/kg	100	-	488.0	242.0	886.0	277.0	106.0
Chrysene	µg/kg	100	-	261.0	125.0	481.0	153.0	64.0
Dibenzo[ah]anthracene	µg/kg	100	-	41.3	17.1	62.9	20.2	8.6
Fluoranthene	µg/kg	100	-	429.0	210.0	878.0	71.3	26.7
Fluorene	µg/kg	100	-	72.6	36.8	157.0	77.8	14.4

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 5 (0m)	Sample 5 (1.0m)	Sample 5 (2.0m)	Sample 5 (3.0m)	Sample 5 (4.0m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	190.0	83.4	348.0	38.2	14.8
Naphthalene	µg/kg	100	-	259.0	125.0	464.0	147.0	80.5
Perylene	µg/kg	100	-	92.1	50.3	147.0	10.8	<5
Phenanthrene	µg/kg	100	-	396.0	184.0	794.0	324.0	146.0
Pyrene	µg/kg	100	-	410.0	201.0	835.0	116.0	39.3
Total Hydrocarbon Content (THC)	mg/kg	-	-	99.8	77.7	129	14.7	6.86
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00247	0.00155	0.005	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.0055	0.00358	0.01141	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	0.0002	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0003	0.0004	0.0008	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0004	0.0003	0.0009	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 5 (0m)	Sample 5 (1.0m)	Sample 5 (2.0m)	Sample 5 (3.0m)	Sample 5 (4.0m)
PPTDE	mg/kg	-	-	0.0059	0.0036	0.0061	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0008	0.0005	0.0014	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0050	0.0003	0.0010	<0.0001	<0.0001
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 17-10: Sediment contamination data for Sample 6 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0m)	Sample 6 (1.0m)	Sample 6 (2.0m)	Sample 6 (3.0m)	Sample 6 (4.0m)
Arsenic	mg/kg	20	100	15.6	23.5	26.5	6	6
Cadmium	mg/kg	0.4	5	0.4	0.41	0.38	0.3	0.38
Chromium	mg/kg	40	400	33.5	42.4	28.8	21.3	27.2
Copper	mg/kg	40	400	22.2	24.8	18.3	13.3	21.5
Lead	mg/kg	50	500	42.1	54.4	39.9	9.70	15.5
Mercury	mg/kg	0.3	3	0.13	0.17	0.1	0.02	0.01
Nickel	mg/kg	20	200	25.5	25.8	19.2	24.1	33.7
Zinc	mg/kg	130	800	109	136	105	43.3	62.6
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	0.01	<0.005	<0.001	<0.001
Acenaphthene	µg/kg	100	-	49.2	50.8	42.0	6.6	17.8
Acenaphthylene	µg/kg	100	-	23.5	33.4	22.0	<5	9.6
Anthracene	µg/kg	100	-	74.6	97.2	79.9	9.0	10.4

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0m)	Sample 6 (1.0m)	Sample 6 (2.0m)	Sample 6 (3.0m)	Sample 6 (4.0m)
Benzo[a]anthracene	µg/kg	100	-	211.0	201.0	163.0	21.5	59.7
Benzo[a]pyrene	µg/kg	100	-	257.0	293.0	220.0	29.2	93.4
Benzo[b]fluoranthene	µg/kg	100	-	240.0	262.0	186.0	34.1	161.0
Benzo[e]pyrene	µg/kg	100	-	206.0	219.0	155.0	47.8	242.0
Benzo[ghi]perylene	µg/kg	100	-	227.0	254.0	179.0	63.8	214.0
Benzo[k]fluoranthene	µg/kg	100	-	247.0	248.0	179.0	21.5	53.8
C1-naphthalenes	µg/kg	100	-	708.0	697.0	566.0	149.0	744.0
C1-phenanthrene	µg/kg	100	-	429.0	395.0	321.0	156.0	510.0
C2-naphthalenes	µg/kg	100	-	577.0	540.0	433.0	134.0	497.0
C3-naphthalenes	µg/kg	100	-	512.0	545.0	410.0	154.0	326.0
Chrysene	µg/kg	100	-	280.0	239.0	190.0	46.2	219.0
Dibenzo[ah]anthracene	µg/kg	100	-	39.1	41.1	29.6	6.2	21.6
Fluoranthene	µg/kg	100	-	429.0	427.0	354.0	39.5	93.7
Fluorene	µg/kg	100	-	78.1	77.6	62.4	18.3	115.0

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0m)	Sample 6 (1.0m)	Sample 6 (2.0m)	Sample 6 (3.0m)	Sample 6 (4.0m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	180.0	209.0	158.0	15.0	49.9
Naphthalene	µg/kg	100	-	255.0	237.0	222.0	32.4	175.0
Perylene	µg/kg	100	-	90.3	100.0	79.5	15.9	14.3
Phenanthrene	µg/kg	100	-	389.0	352.0	293.0	110.0	425.0
Pyrene	µg/kg	100	-	402.0	425.0	336.0	56.9	146.0
Total Hydrocarbon Content (THC)	mg/kg	-	-	94.2	122	59.9	16.6	17.2
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00302	0.00443	0.00292	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.00639	0.00959	0.00651	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0006	0.0008	0.0003	<0.0001	0.0001
HCB	mg/kg	-	-	0.0003	0.0005	0.0005	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0m)	Sample 6 (1.0m)	Sample 6 (2.0m)	Sample 6 (3.0m)	Sample 6 (4.0m)
PPTDE	mg/kg	-	-	0.0048	0.0069	0.0039	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0010	0.0015	0.0008	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0014	0.0034	0.0002	<0.0001	0.0002
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 17-11: Sediment contamination data for Sample 7 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 7 (0m)	Sample 7 (1.0m)	Sample 7 (1.4m)
Arsenic	mg/kg	20	100	15.3	5.5	1.3
Cadmium	mg/kg	0.4	5	0.67	0.28	0.43
Chromium	mg/kg	40	400	16.6	16.0	4.40
Copper	mg/kg	40	400	10.1	14.1	4.90
Lead	mg/kg	50	500	14.8	8.9	2.80
Mercury	mg/kg	0.3	3	0.02	<0.01	<0.01
Nickel	mg/kg	20	200	23.6	20.1	12.6
Zinc	mg/kg	130	800	68.2	34.3	15.4
Dibutyltin (DBT)	mg/kg	0.1	1	<0.001	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.001	<0.001	<0.001
Acenaphthene	µg/kg	100	-	<5	<5	<1
Acenaphthylene	µg/kg	100	-	<5	<5	<1
Anthracene	µg/kg	100	-	3.3	<5	<1

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 7 (0m)	Sample 7 (1.0m)	Sample 7 (1.4m)
Benzo[a]anthracene	µg/kg	100	-	8.1	<5	<1
Benzo[a]pyrene	µg/kg	100	-	6.9	<5	<1
Benzo[b]fluoranthene	µg/kg	100	-	9.1	<5	<1
Benzo[e]pyrene	µg/kg	100	-	13.9	68.4	1.2
Benzo[ghi]perylene	µg/kg	100	-	13.4	<5	<1
Benzo[k]fluoranthene	µg/kg	100	-	5.7	<5	<1
C1-naphthalenes	µg/kg	100	-	50.6	227.0	3.3
C1-phenanthrene	µg/kg	100	-	47.8	191.0	3.5
C2-naphthalenes	µg/kg	100	-	46.4	182.0	2.6
C3-naphthalenes	µg/kg	100	-	56.8	179.0	2.7
Chrysene	µg/kg	100	-	14.6	64.0	1.3
Dibenzo[ah]anthracene	µg/kg	100	-	<5	<5	<1
Fluoranthene	µg/kg	100	-	15.1	<5	<1
Fluorene	µg/kg	100	-	<5	<5	<1

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 7 (0m)	Sample 7 (1.0m)	Sample 7 (1.4m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	<5	<5	<1
Naphthalene	µg/kg	100	-	13.9	<5	<1
Perylene	µg/kg	100	-	<5	<5	<1
Phenanthrene	µg/kg	100	-	<5	159.0	2.5
Pyrene	µg/kg	100	-	21.7	65.3	1.4
Total Hydrocarbon Content (THC)	mg/kg	-	-	20.2	8.58	3.81
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00056	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.002	0.002	0.002
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration		
		AL1	AL2	Sample 7 (0m)	Sample 7 (1.0m)	Sample 7 (1.4m)
PPTDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0014	<0.0001	0.0002
Key	Below AL1					
	Above AL1, Below AL2					
	Above AL2					

Table 17-12: Sediment contamination data for Sample 8 collected in March 2023

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 8 (0m)	Sample 8 (1.0m)	Sample 8 (2.0m)	Sample 8 (2.9m)
Arsenic	mg/kg	20	100	10.8	5.9	1	<0.5
Cadmium	mg/kg	0.4	5	0.44	0.11	0.26	0.15
Chromium	mg/kg	40	400	20.2	18.9	0.90	1.00
Copper	mg/kg	40	400	13.6	13.9	3.90	5.10
Lead	mg/kg	50	500	14.1	9.10	1.40	1.50
Mercury	mg/kg	0.3	3	0.03	0.03	0.01	<0.01
Nickel	mg/kg	20	200	26.1	23.8	8.30	6.60
Zinc	mg/kg	130	800	58.4	43.9	18.0	14.6
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.001	<0.001	<0.001
Acenaphthene	µg/kg	100	-	5.3	<1	<1	<1
Acenaphthylene	µg/kg	100	-	1.7	<1	<1	<1
Anthracene	µg/kg	100	-	7.0	<1	<1	<1

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 8 (0m)	Sample 8 (1.0m)	Sample 8 (2.0m)	Sample 8 (2.9m)
Benzo[a]anthracene	µg/kg	100	-	23.7	<1	<1	<1
Benzo[a]pyrene	µg/kg	100	-	31.1	<1	<1	<1
Benzo[b]fluoranthene	µg/kg	100	-	36.4	<1	<1	<1
Benzo[e]pyrene	µg/kg	100	-	48.3	<1	<1	<1
Benzo[ghi]perylene	µg/kg	100	-	65.0	<1	<1	<1
Benzo[k]fluoranthene	µg/kg	100	-	20.0	<1	<1	<1
C1-naphthalenes	µg/kg	100	-	116.0	<1	<1	1.3
C1-phenanthrene	µg/kg	100	-	137.0	<1	<1	<1
C2-naphthalenes	µg/kg	100	-	108.0	<1	<1	<1
C3-naphthalenes	µg/kg	100	-	111.0	<1	<1	<1
Chrysene	µg/kg	100	-	48.6	<1	<1	<1
Dibenzo[ah]anthracene	µg/kg	100	-	5.8	<1	<1	<1
Fluoranthene	µg/kg	100	-	38.4	<1	<1	<1
Fluorene	µg/kg	100	-	15.0	<1	<1	<1

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 8 (0m)	Sample 8 (1.0m)	Sample 8 (2.0m)	Sample 8 (2.9m)
Indeno[1,2,3-cd]pyrene	µg/kg	100	-	18.0	<1	<1	<1
Naphthalene	µg/kg	100	-	24.9	<1	<1	<1
Perylene	µg/kg	100	-	13.4	<1	<1	<1
Phenanthrene	µg/kg	100	-	92.8	<1	<1	<1
Pyrene	µg/kg	100	-	58.6	<1	<1	<1
Total Hydrocarbon Content (THC)	mg/kg	-	-	5.14	10.9	<1	<1
PCBs – Sum of ICES 7	mg/kg	0.02	0.01	0.00056	0.00056	0.00056	0.00056
PCBs – Sum of 25 Congeners	mg/kg	0.2	-	0.0	0.0	0.0	0.0
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 8 (0m)	Sample 8 (1.0m)	Sample 8 (2.0m)	Sample 8 (2.9m)
PPTDE	mg/kg	-	-	0.0003	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	<0.0001	<0.0001	<0.0001	<0.0001
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

Future baseline

17.6.21 In the absence of the Project, water and sediment quality will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns, and trends (e.g. changes in prevalence of chemicals in marine sediments in response to legislative controls, degradation of some contaminants, ongoing maintenance dredging and disposal, and existing discharge licences in the area). The future baseline will also be influenced by climate change, such as changes in sea pH and temperature, which in turn can have an impact on water quality (e.g. dissolved oxygen concentrations). These parameters have been factored into the assessment of potential changes to marine water and sediment quality introduced via the Project.

17.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

17.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to marine water and sediment quality through the process of design development, and by embedding mitigation measures into the design, such as minimising the dredge requirements as far as possible.

Standard Mitigation Measures

17.7.2 Standard mitigation measures will be undertaken to manage commonly occurring environmental effects. Although these are not likely to alter the assessment conclusions, they are considered to be standard good practice. In terms of water and sediment quality, the potential risk from accidents and spillages/leaks during construction will be avoided or minimised by ensuring that the construction methods, proposed design, and the contractual arrangements follow environmental management best practice. In particular, the following guidance will be adopted:

a. ‘Pollution prevention for businesses’ Guidance in England (Ref 17-26).

b. Pollution Prevention Guidance (“PPG”), or Guidance for Pollution Prevention (“GPP”) in the UK (Ref 17-27);

   i Understanding Your Environmental Responsibilities – Good Environmental Practices (“PPG1”).

   ii Works and maintenance in or near water (“GPP5”).

   iii Working at construction and demolition sites (“PPG6”).

   iv Safe storage and disposal of used oils (“GPP8”).

c. The Oil Care Code.

d. CIRIA’s Environmental Good Practice on Site (Ref 17-28).

17.7.3 In adhering to this guidance, a number of good practice measures will be followed. All wastes generated on site will be removed in a timely manner and any materials and containers giving rise to possible spills or contamination of the surrounding environment will be taken from site to be processed at a licensed facility. Liquid oils/chemicals required for use during construction will be stored in suitable containers/bunded storage areas. In the event of a pollution incident measures to report, manage, and minimise any impacts will be pursued, with construction spill response procedures to contain any accidental spills. In addition, an oil spill contingency plan is currently in place for the Port of Immingham to minimise any impacts in the event of a spill entering the water and these measures would also be applicable to the Project.

17.7.4 Plant will also be maintained regularly, and spill kits will be available for use in the event of a spill onsite. Refuelling will be in designated areas to limit the potential for spillages. Fuel will be stored in the Site compound overnight, limiting the potential for fuel theft and vandalism which could cause pollution. Should any pollution incidents occur, they will be reported immediately to the relevant authorities. The workforce will be trained in preventing and dealing with pollution incidents.

17.7.5 An **Outline CEMP [TR030008/APP/6.5]** has been prepared and provided with the DCO application which sets out the mitigation measures considered necessary to manage environmental effects during construction as described above.

17.8 Assessment of Likely Impacts and Effects

17.8.1 The assessment has identified potential likely effects on marine water and sediment quality receptors as a result of the construction and subsequent operation of the Project.

17.8.2 The Physical Processes assessment (**Chapter 16: Physical Processes [TR030008/APP/6.2]**) has informed the outcomes of the Marine Water and Sediment Quality assessment.

17.8.3 Cumulative impacts on water and sediment quality that could arise as a result of other coastal and marine developments and activities in the Humber Estuary are considered as part of the cumulative impacts and in-combination effects assessment (**Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**).

Construction

17.8.4 This section contains an assessment of the potential impacts to marine water and sediment quality receptors as a result of the construction phase of the Project. The following impact pathways have been identified as having potential for significant effects and have been assessed:

a. Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities.

b. Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities;.

c. Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities.

d. Changes to marine water quality from accidental spillages or leaks during construction.

Changes to dissolved oxygen concentrations as a result of increased SSC

Capital dredging

17.8.5 The increase in chemical and biological oxygen demand associated with elevated SSC in the water column during capital dredging may have the potential to reduce dissolved oxygen concentrations. The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are unlikely to influence dissolved oxygen concentrations, to clays including alluvium deposits containing organic material (see **Section 17.6** and **Table 17-4**:), for which organic content can result in reduced dissolved oxygen concentrations. For the use of backhoe, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the bucket).

17.8.6 The proposed dredge area is situated within the Humber Lower transitional water body. The physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2022 interim classification, at high status for this water body (dissolved oxygen concentration of > 5.7 mg/l for 95% of the time), despite the area being subject to regular maintenance dredging activities. It is, therefore, considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of the proposed capital dredging.

17.8.7 Numerical modelling has been carried out to inform the assessment of the impacts of capital dredging on SSC and this indicates that increases in SSC will be short-term and localised to the dredging activity (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). It is anticipated that any reduction in dissolved oxygen concentration will be short-lived and replenished over the subsequent tidal cycle. Therefore, the magnitude of change is considered to be low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Piling

17.8.8 The increase in chemical and biological oxygen demand associated with elevated SSC in the water column during piling activity may, as with dredging, have the potential to reduce dissolved oxygen concentrations. However, the effects are anticipated to be highly localised (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). The piling activity is proposed to occur within the Humber Lower transitional water body, for which the physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2022 interim classification, at high status. The seabed in the area is already subject to regular disturbance (e.g., maintenance dredging) and, therefore, it is considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of piling.

17.8.9 Based on the above, the magnitude of change is considered to be very low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Disposal activities

17.8.10 The disposal of dredged material at sea associated with the Project will be fulfilled at licensed disposal sites HU056 (for any inerodible boulder/glacial clay) and HU060 (for any sand/silt (alluvium) material) (see **Chapter 2: The Project [TR030008/APP/6.2]**). Numerical modelling has been carried out to inform the assessment of the impacts of disposal on SSC (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**).

17.8.11 During the placement of dredged material at the licensed disposal sites, the potential for reduction in dissolved oxygen concentrations in the water column is considered to be low based on modelling of the sediment plume dispersal which indicates that SSC levels are likely to become immeasurable above baseline within 1km of the disposal site. The measurable plume from each disposal operation is only likely to persist for a single tidal cycle (less than 6 hours from disposal). After this time, the dispersion under the peak flood or ebb tidal flows means concentrations will have reverted to background levels (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). Any changes would be localised and short-lived given the dynamic nature of the site, which would rapidly be re-oxygenated. Both HU056 and HU060 licensed disposal sites are located within the Humber Lower transitional water body for which the physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2022 interim classification, at high status, despite routinely receiving maintenance dredging material from the ports within the Humber Estuary.

17.8.12 The magnitude of change is considered to be low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Changes to chemical water quality as a result of potential sediment-bound contaminants

Capital dredging

17.8.13 The proposed dredge area is situated within the Humber Lower transitional water body. This water body is currently, based on a 2022 interim classification, failing chemical status due to cypermethrin and dichlorvos, PBDEs, PFOS, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds and TBT compounds.

17.8.14 As sediment is disturbed and re-distributed into the water column, any sediment-bound contaminants may be partitioned from the solid phase (i.e., bound to sediments or suspended matter), to the dissolved or aqueous phase (i.e., dissolved in pore water or overlying water) (Ref 17-29). To determine the maximum dissolved fraction of contaminants released into the water column, it is necessary to consider the relative potential for each contaminant to change from one phase to another (i.e., contaminant adsorbed to sediment surfaces to dissolved in the water), referred to as the partition coefficient. Partition coefficients describe the ratio between the freely dissolved concentration in water and another environmental phase (e.g., sediment-bound) at equilibrium. It should be noted that desorption rates of contaminants from suspended sediments into the water column are highly regulated by hydrodynamics, biogeochemical processes, and environmental conditions (redox, pH, salinity, and temperature) (Ref 17-30). Due to the variability in environmental conditions, a wide range of partition coefficients are reported in the literature.

17.8.15 There is potential for sediment-bound contaminants to be re-mobilised in the water column following an increase in SSC during the proposed capital dredging. Sediment disturbance will be caused at the bed by abrasion pressure from the dredging equipment (i.e., bucket). As noted in **Chapter 16: Physical Processes [TR030008/APP/6.2]**, maximum SSCs are associated with the disposal activities (with relatively small increases in SSC arising from the dredge itself). Peak excess SSC levels resulting from the disposal activities are predicted to be around 600 to 800 mg/l at HU060 licensed disposal site (this site is likely to receive the vast majority of the more unconsolidated dredged material, whereas HU056 will be used for any inerodible boulder/glacial clay, see **Chapter 2: The Project [TR030008/APP/6.2]**). Increased SSCs arising from the dredge operations will be of lower magnitude and persist for a shorter distance (and time) than that from the disposal. Therefore, while a different activity, the estimated maximum incremental SSC for disposal activities is considered here on a precautionary basis.

17.8.16 A Microsoft Excel Spreadsheet tool developed by APEM Ltd, referred to as SeDiChem (short for Sediment Disturbance on Chemical status), was provided by the Environment Agency to support consideration of potential uplift in contaminant concentrations following disturbance of contaminated sediments in estuarine and marine waters.

17.8.17 **Table 17-13**: provides a summary of the SeDiChem tool outputs, with empirical calculations based on a number of simple assumptions. This includes general site parameters (e.g., net flow rate of 20,736,000m³/day based on an average for the Humber of 240m³/second (Ref 17-36)), maximum incremental SSC (800 mg/l), worst case (or precautionary) partition coefficients from suggested literature and sediment quality from samples collected within the proposed dredge area. In addition, background water quality concentrations have been inputted based on Environment Agency monitoring data from nearby monitoring station Clean Site - Ti02 Monitoring Point, 1985 (sampling ID: AN-CLNMON1) (see **Section 17.6** of this chapter), averaged across the most recent five years of data.

17.8.18 Overall, the uplift in contaminant concentrations is anticipated to be minimal, and unlikely to present a significant issue at the water body level. Where contaminants are already reported to be failing within the water body (e.g., PBDEs, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds and TBT compounds), any disturbance of sediments during dredging activities will result in an uplift effectively causing a 'worse failure'. However, the scale of this deterioration is considered to be small and highly localised. As a percentage increase of EQS headroom (i.e., the capacity for the concentration to increase whilst still remaining below the environmental threshold), the increased concentration due to dredging is likely to be less than 1% for mercury, and 70% for TBT. For benzo(a)pyrene, benzo(b)fluoranthene, benzo(g-h-i)perylene, and benzo(k)fluoranthene, the background dissolved concentration is above the EQS, therefore no headroom is available according to the SeDiChem tool. However, as a percentage increase of background concentrations, the increase in concentration of these contaminants as a result of dredging is calculated as < 1%. Furthermore, these calculations are based on a maximum sediment concentration and worst-case partition coefficients. It is, therefore, considered unlikely that the proposed dredging activity would cause even a short-term deterioration in water quality with regards to contaminants.

17.8.19 Based on the above, the magnitude of change is considered to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Table 17-13: Potential contaminant concentrations as a result of the Project in the Humber Lower transitional water body based on SeDiChem tool outputs

Parameter	Max. Sediment Concentration (mg/kg)	Current WFD Status	Partition Coefficient (l/kg)	EQS (µg/l)	Dissolved Concentration (Background* and Dredging) (µg/l)	Concentration Increase due to Dredging (% of Background)	Concentration Increase as % of EQS Headroom
Arsenic	31.40	High	40	25 (dissolved)	3.374	45.42%	4.65%
Cadmium	0.67	Good	100	0.2 (dissolved)	0.099	10.28%	8.41%
Chromium	59.20	High	79	32 (dissolved)	1.273	324.34%	3.07%
Copper	37.90	High	3,162	3.76 (dissolved)	2.946	0.56%	1.96%
Lead	75.30	Good	35,481	14 (dissolved)	0.083	3.56%	0.02%
Mercury	0.25	Fail	6,310	0.07 (dissolved)	0.013	0.40%	0.09%
Nickel	45.50	Good	500	34 (dissolved)	2.549	4.91%	0.38%
Zinc	189.00	High	12,589	8.8 (dissolved)	4.560	0.44%	0.60%
Benzo(a)pyrene	0.51	Fail	9,120	0.027 (total)	0.040	0.18%	No headroom
Benzo(b) fluoranthene	0.43	Fail	20,795	0.017 (total)	0.040	0.07%	No headroom
Benzo(g,h,i) perylene	0.40	Fail	18,904	0.00082 (total)	0.040	0.07%	No headroom

Parameter	Max. Sediment Concentration (mg/kg)	Current WFD Status	Partition Coefficient (l/kg)	EQS (µg/l)	Dissolved Concentration (Background* and Dredging) (µg/l)	Concentration Increase due to Dredging (% of Background)	Concentration Increase as % of EQS Headroom
Benzo(k) fluoranthene	0.42	Good	19,859	0.017 (total)	0.02	0.14%	No headroom
Fluoranthene	0.88	Good	1,396	0.12 (total)	0.041	2.10%	1.05%
Tributyltin (TBT)	0.03	Fail	49	0.0015 (total)	0.001	190.94%	69.43%
Hexachloro-benzene	0.001	Good	5,978	0.05 (total)	0.002	0.011%	0.00%

Piling

17.8.20 As discussed for capital dredging above and in **Chapter 16: Physical Processes [TR030008/APP/6.2]**, maximum SSCs are associated with the disposal activities. Peak excess SSC levels resulting from the disposal activities are predicted to be around 600 to 800 mg/l at the HU060 licensed disposal site. Increased SSCs arising from the dredge operations will be of lower magnitude and persist for a shorter distance (and time) than that from the disposal. The anticipated increased SSC concentration related to piling will be less than that of dredging and disposal, as compaction will occur in the sediment rather than complete disturbance. **Table 17-13**: calculates the potential for sediment-bound contaminants to increase the concentration of in-water contaminants and, even when applying SSCs of 800mg/l, the proposed piling works are considered unlikely to result in significant water quality impacts.

17.8.21 Overall, the magnitude of change is likely to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Disposal activities

17.8.22 As discussed for capital dredging above and in **Chapter 16: Physical Processes [TR030008/APP/6.2]**, maximum SSCs are associated with the disposal activities. Peak excess SSC levels resulting from the disposal activities are predicted to be around 600 to 800 mg/l at the HU060 licensed disposal site. **Table 17-13**: calculates the potential for sediment-bound contaminants to increase the concentration of in-water contaminants and, even when applying SSCs of 800mg/l, the proposed piling works are considered unlikely to result in significant water quality impacts.

17.8.23 Overall, the magnitude of change is likely to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Redistribution of sediment-bound contaminants

Capital dredging

17.8.24 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere. However, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the bucket).

17.8.25 The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are generally unlikely to comprise high contaminant levels due to the material characteristics, to muds, silts and clays which are more typically associated with sediment-bound contaminants. The majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. Furthermore, sedimentation in relation to the dredging of the berth pocket is predicted to be relatively localised (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution and deposition of material during capital dredging.

17.8.26 Overall, the magnitude of change is likely to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Piling

17.8.27 Similar to capital dredging (see above), the potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere.

17.8.28 However, the majority of contaminants in the sediments in the vicinity of the proposed piling activity are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. Furthermore, sedimentation away from the piling locations is predicted to be highly localised (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution and deposition of material during piling.

17.8.29 Overall, the magnitude of change is likely to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Disposal activities

17.8.30 The disposal of dredged material at sea associated with the Project will be fulfilled at licensed disposal sites HU056 and HU060 within the Humber Estuary (see **Chapter 2: The Project [TR030008/APP/6.2]**).

17.8.31 During the placement of dredged material at the licensed disposal sites, any sediment-bound contaminants within the dredge material will effectively be dispersed and redistributed by the disposal activity. However, the majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed and it is considered

that the dredge material is suitable for disposal at sea. It is also noted that disposal site HU060 routinely receives maintenance dredging material from ports within the Humber Estuary. These disposal sites, located within the Humber Estuary, will have similar levels of contamination to the dredge material and therefore disposal activity is not expected to lead to elevated concentrations of contaminants above prevailing background levels.

17.8.32 Overall, the magnitude of change is likely to be very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

Changes to marine water quality from accidental spillages or leaks during construction

17.8.33 Accidental spillages of oil and other substances have the potential to occur during construction from both land and marine-based plant and vessels. Depending on the source, spillages and leaks can potentially introduce contaminants which could reduce marine water quality. A range of standard practice pollution prevention guidelines have been outlined in **Section 17.7** and will be followed to minimise the risk of accidental spillages and the risk of introduction of contaminants throughout construction. This not only reduces the potential risk from accidents and spillages/leaks during construction but also outlines the response if such an event were to occur.

17.8.34 Given the low likelihood of this impact occurring and the measures in place to address an incident if one were to occur, the magnitude of change is considered very low. The sensitivity/importance is medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Therefore, the impact significance is assessed as **minor adverse** and **not significant**.

17.8.35 Risks associated with major incidents are considered in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

Operation

17.8.36 This section contains an assessment of the potential impacts to water and sediment quality receptors as a result of the operational phase of the Project. The following impact pathways have been assessed:

a. Changes to dissolved oxygen concentrations as a result of increased SSC during the maintenance dredging and disposal activities.

b. Changes to chemical water quality as a result of potential sediment-bound contaminants being released during maintenance dredging and disposal activities.

c. Redistribution of sediment-bound contaminants during maintenance dredging and disposal activities.

Changes to dissolved oxygen concentrations as a result of increased SSC

Maintenance dredging

17.8.37 The need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all) (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements). The volumes of material from maintenance dredging will be lower than those from the original capital dredge. Furthermore, the density of the newly settled material will be less than that from the consolidated bed dredged during the capital dredge campaign. As a result, maintenance dredge arisings and disposal will have a notably lower magnitude and the dredged material being deposited will be more dispersive than the impacts described above for the capital works during construction.

17.8.38 The increase in chemical and biological oxygen demand associated with elevated SSC in the water column during maintenance dredging may have the potential to reduce dissolved oxygen concentrations. The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are unlikely to influence dissolved oxygen concentrations, to clays including alluvium deposits containing organic material (see **Section 17.6** and **Table 17-4**:), for which organic content can result in reduced dissolved oxygen concentrations. That said, it should be noted that the material to be removed during the maintenance dredging campaign will have been recently deposited and in reduced volumes compared to the capital dredge. Furthermore, the majority of material disturbed during maintenance dredging works will be lifted from the bed to the hopper, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the bucket).

17.8.39 The dredge area is situated within the Humber Lower transitional water body. The physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2022 interim classification, at high status for this water body, despite the area being subject to regular disturbance from dredging. It is, therefore, considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of the proposed maintenance dredging.

17.8.40 Numerical modelling of the capital dredge has shown that increases in SSC will be short-term and localised to the dredging activity and therefore as the maintenance dredging volumes are smaller the change in SSC would be lower than that of the capital dredge (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). It is anticipated that any reduction in dissolved oxygen concentration will be short-lived and replenished over the subsequent tidal cycle. Therefore, the magnitude of change is considered to be low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Disposal activities

17.8.41 As noted above and in **Chapter 16: Physical Processes [TR030008/APP/6.2]**, the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all). Volumes of material from maintenance dredging of the Project berth pocket will be lower than those from the original capital dredge. Whilst the overall maintenance dredge volume will potentially increase very slightly as a result of the Project, the amount will be far below the current overall annual licensed volume for Immingham. Of particular importance in relation to potential effects, the frequency and volume of material deposited from each load will not change compared with current maintenance dredging activities as the same plant and methods are proposed to be used. Future disposal of maintenance dredge arisings will, therefore, result in the same changes in SSC within the disposal plumes as existing maintenance dredging activities undertaken for the Port.

17.8.42 During operation the disposal of dredged material (which would be sand/silt (alluvium)) at sea associated with the Project will be fulfilled at licensed disposal site HU060 (see **Chapter 2: The Project [TR030008/APP/6.2]**).

17.8.43 During the placement of dredged material at the Clay Huts licensed disposal site (HU060), the potential for reduction in dissolved oxygen concentrations in the water column is considered to be low. Any changes would be localised and short-lived given the dynamic nature of the site, which would rapidly be re-oxygenated. HU060 is located within the Lower Humber water body for which the physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2022 interim classification, at high status, despite routinely receiving maintenance dredging material from ports within the Humber Estuary. It should be noted that material to be disposed during the maintenance dredging campaign would be recently deposited and in reduced volumes compared to the capital dredge.

17.8.44 The magnitude of change is considered to be low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Changes to chemical water quality as a result of potential sediment-bound contaminants

Maintenance dredging

17.8.45 As discussed for capital dredging above, the proposed maintenance dredging activities are considered unlikely to result in significant water quality impacts. The level of contamination of the material that will be removed through maintenance dredging (if required at all) is anticipated to be similar to the existing surficial sediment samples collected within the vicinity of the Project (see **Section 17.6**). Overall, the magnitude of change is considered very low. The sensitivity/ importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Disposal activities

17.8.46 As discussed for the proposed disposal of capital dredge material above, the proposed disposal activities for maintenance dredging are considered unlikely to result in significant water quality impacts. Maximum SSCs are associated with the disposal activities and peak excess SSC levels resulting from the disposal activities are predicted to be around 600 to 800 mg/l at the HU060 licensed disposal site. The level of contamination of the material that will be removed through maintenance dredging is anticipated to be similar to the existing surficial sediment samples collected within the vicinity of the Project (see **Section 17.6**). It should also be noted that this disposal site is already used and has been used by the Port of Immingham for the disposal of maintenance dredge material for over 30 years.

17.8.47 Overall, the magnitude of change is considered very low. The sensitivity/importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

Redistribution of sediment-bound contaminants

Maintenance dredging

17.8.48 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere.

17.8.49 The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are generally unlikely to comprise high contaminant levels, to muds, silts and clays which are more typically associated with sediment-bound contaminants. The results of the sediment sampling analysis from within the proposed dredge area confirmed that contaminants are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. Furthermore, sedimentation in relation to dredging of the berth pocket is predicted to be relatively localised and the need for future maintenance dredging within the new berth pocket is expected to be very limited (if required at all) (see **Chapter 16: Physical Processes [TR030008/APP/6.2]**). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution of material during maintenance dredging. In addition, maintenance dredging of the Project berth will be carried out in line with the existing regime across the Port which requires regular sediment sampling and testing to ensure the material remains suitable for disposal at sea.

17.8.50 Overall, the magnitude of change is considered very low. The sensitivity/ importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse and not significant**.

Disposal activities

17.8.51 The disposal of maintenance dredged material at sea associated with the Project will be fulfilled at licensed disposal site HU060 (see **Chapter 2: The Project [TR030008/APP/6.2]**).

17.8.52 During the placement of dredged material at the Clay Huts licensed disposal site (HU060), any sediment-bound contaminants within the dredge material will effectively be redistributed by the disposal activity. As discussed in the preceding sections, material types more typically associated with sediment-bound contaminants are muds, silts and clays and all recent sediment sampling data has returned contaminant levels at or around Cefas AL1. Material removed during the maintenance dredging campaign would be recently deposited alluvium and in reduced volumes compared to the capital dredge. It is also anticipated to be similar to the surficial sediment samples shown in **Section 17.6**. The proposed HU060 licensed disposal site has received maintenance dredge arisings from the Port of Immingham (and other ports within the Humber Estuary) for more than 30 years and periodic sediment sampling to assess the suitability for disposal at sea will continue in accordance with the conditions of the Port's existing maintenance dredge licences. This will ensure the material remains suitable for disposal at sea.

17.8.53 Overall, the magnitude of change is considered very low. The sensitivity/ importance is considered medium, given that the Humber Estuary can accommodate the change without detriment but is considered of high importance. Given this, the impact significance is assessed as **minor adverse** and **not significant**.

17.9 Mitigation and Enhancement Measures

17.9.1 None of the impact pathways assessed in **Section 17.8** are considered to result in significant adverse effects and, therefore, no mitigation is needed to address the effects. However, embedded and standard mitigation measures are provided in **Section 17.7**.

17.10 Assessment of Residual Effects

17.10.1 The following sections summarise the likely effects on Marine Water and Sediment Quality receptors.

Construction

17.10.2 The assessment considered four impact pathways in detail during construction as a result of the capital dredging, piling and disposal activities. These addressed the potential for impacts as a result of the potential changes to dissolved oxygen concentrations, changes to chemical water quality as a result of potential sediment-bound contaminants, redistribution of sediment-bound contaminants, and accidental spillages or leaks.

17.10.3 All of the potential impacts on marine water and sediment quality receptors during construction were assessed as not significant. Given this, no specific mitigation measures have been identified as being likely to be required, and residual effects remain unchanged. However, standard mitigation measures will be undertaken to manage commonly occurring environmental effects (see **Section 17.7**). As noted in **Section 17.7**, an outline CEMP has been prepared and provided with the DCO application which sets out the mitigation measures considered necessary to manage environmental effects during construction **[TR030008/APP/6.5]**. This will be implemented prior to works commencing and during works as relevant.

Operation

17.10.4 The assessment considered three impact pathways in detail during operation as a result of maintenance dredging and disposal activities. These addressed the potential for impacts as a result of the potential changes to dissolved oxygen concentrations, changes to chemical water quality as a result of potential sediment-bound contaminants, and redistribution of sediment-bound contaminants.

17.10.5 As for impacts during construction, all of the potential impacts on marine water and sediment quality receptors during operation were assessed as not significant. Given this, no specific mitigation measures have been identified as being likely to be required, and residual effects remain unchanged. However, standard mitigation measures will be undertaken to manage commonly occurring environmental effects.

Decommissioning

17.10.6 The DCO will not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and the jetty access road, would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that they can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements. On this basis, potential effects on marine water and sediment quality receptors from decommissioning have been scoped out.

17.11 Summary of Assessment

17.11.1 A summary of the impact pathways that have been assessed, together with the identified residual impacts and level of confidence is presented in **Table 17-14**:. The confidence assigned to the impact pathways relating to sediment-bound contaminants is considered ‘High’ as it is based on site-specific sampling and chemical analysis of sediments within the dredge area. A ‘Medium’ level of confidence is assigned to impact pathways relating to dissolved oxygen as no site-specific data has been collected for this Project, however, concentrations of

dissolved oxygen are measured regularly in the Humber Estuary and are well understood.

Table 17-14: Summary of potential impact, mitigation measures and residual impacts

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
Construction Phase					
Marine water and sediment quality	Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities	Minor adverse	N/A	Minor adverse	Medium
	Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities	Minor adverse	N/A	Minor adverse	High
	Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities	Minor adverse	N/A	Minor adverse	High
	Changes to marine water quality from accidental spillages of leaks	Minor adverse	N/A	Minor adverse	High
Operational Phase					
Marine water and sediment quality	Changes to dissolved oxygen concentrations as a result of increased SSC during the maintenance dredging and disposal activities	Minor adverse	N/A	Minor adverse	Medium
	Changes to chemical water quality as a result of potential contaminants in the seabed sediment being released during maintenance dredging and disposal activities	Minor adverse	N/A	Minor adverse	High

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual Effect	Confidence
	Redistribution of sediment-bound contaminants during maintenance dredging and disposal activities	Minor adverse	N/A	Minor adverse	High

17.12 References

Ref 17-1 The Stationery Office Limited (2009). Marine and Coastal Access Act 2009.

Ref 17-2 The Stationery Office Limited (2008). Planning Act 2008.

Ref 17-3 The Stationery Office (2017a). Statutory Instrument 2017 No. 407. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Ref 17-4 The Stationery Office Limited (2015). WFD (Standards and Classification) Directions (England and Wales) 2015.

Ref 17-5 The Stationery Office Limited (2013). 2013 No. 1675 Water Resources, The Bathing Water Regulations 2013.

Ref 17-6 The Stationery Office Limited (2015). 2015 No. 668 The Nitrate Pollution Prevention Regulations 2015.

Ref 17-7 The Stationery Office Limited (2014). 2014 No. 2841 Urban Waste Water Treatment (England and Wales) Regulations 1994.

Ref 17-8 The Stationery Office (2016). The Shellfish Water Protected Areas (England and Wales) Directions 2016 (2016 No.5).

Ref 17-9 The Stationery Office (2017b). Statutory Instrument 2017. No. 1012. The Conservation of Habitats and Species Regulations 2017.

Ref 17-10 Department for Transport (2012). The National Planning Policy Statement for Ports.

Ref 17-11 The Stationery Office Limited (2011). UK Marine Policy Statement.

Ref 17-12 Department for Environment, Food and Rural Affairs (Defra) (2019a). UK Marine Strategy.

Ref 17-13 Department for Environment, Food and Rural Affairs. (2019b). Marine strategy part one: UK updated assessment and Good Environmental Status.

Ref 17-14 HM Government (2014). East Inshore and East Offshore Marine Plans.

Ref 17-15 North East Lincolnshire Council (2018). North East Lincolnshire Local Plan.

Ref 17-16 Environment Agency (2016). Water Framework Directive assessment: estuarine and coastal waters. Clearing the Waters for All.

Ref 17-17 Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive.

Ref 17-18 Environment Agency. (2022a). Catchment Data Explorer.

Ref 17-19 Environment Agency. (2022b). Find a bathing water.

Ref 17-20 Department for Environment, Food and Rural Affairs. (2016). Water Framework Directive. List of Shellfish Water Protected Areas in England. March 2016. Department for Environment, Food and Rural Affairs.

Ref 17-21 Environment Agency. (2022c). Check for drinking water safeguard zones and NVZs.

Ref 17-22 Department for Environment, Food and Rural Affairs. (2019a). Urban waste water treatment: updated sensitive areas maps 2019.

Ref 17-23 Environment Agency. (2022d). Water quality data archive.

Ref 17-24 Marine Management Organisation. (2014). Marine Licencing: sediment analysis and sample plans.

Ref 17-25 Cefas (2020). Review of Action Levels used for assessing dredging and disposal marine licences.

Ref 17-26 Department for Environment, Food and Rural Affairs and Environment Agency (2019). Pollution prevention for businesses.

Ref 17-27 NetRegs. (2020). Guidance for Pollution Prevention (GPPs) - Full list.

Ref 17-28 CIRIA. (2015). Environmental good practice on site (fourth edition).

Ref 17-29 Luoma, S. N. (1983). Bioavailability of trace metals to aquatic organisms—a review. Science of the Total Environment, 28, 1-22.

Ref 17-30 Eggleton, J. and Thomas, K. V. (2004). A review of factors affecting the release and bioavailability of contaminants during sediment disturbance events. Environmental International, 30, 973-980.

Ref 17-31 The Stationary Office Limited (2018). The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

Ref 17-32 The Stationary Office Limited (2019). Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

Ref 17-33 Mason, C.; Vivian, C.; Griffith, A.; Warford, L.; Hynes, C.; Barber, J.; Sheahan, D.; Bersuder, P.; Bakir, A.; Lonsdale, J.-A. 2022. Reviewing the UK's Action Levels for the Management of Dredged Material. Geosciences, 12, 3.

Ref 17-34 Natural England, 2020. MAGIC Interactive Map.

Ref 17-35 OSPAR Commission, 2014. OSPAR Guidelines for the management of dredged material at sea. OSPAR 2014-06.

Ref 17-36 Environment Agency, 2008. Understanding and Managing Morphological Change in Estuaries.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage

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Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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18 Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage

18.1 Introduction

18.1.1 This chapter of the Environmental Statement ("ES") has been produced to assess the likely significant effects of the Project on water use, water quality, coastal protection, flood risk and drainage.

18.1.2 The impact assessment has been undertaken in accordance with the following broad stages:

a. Reviewing the planning and legislative context.

b. Establishing the baseline.

c. Appraisal of potential impacts and determining the classification and significance of effects.

d. Identification of potential mitigation and enhancement measures.

e. Identification of any residual likely significant effects.

18.1.3 Environmental effects have been assessed for the construction, operational and decommissioning phases of the Project. The residual effects reported at the end of this chapter take account of embedded mitigation and the implementation of additional mitigation measures as described in this chapter.

18.1.4 There are interrelationships related to the Project's potential effects on water quality, coastal protection, flood risk and drainage and other disciplines. Therefore, reference should also be made to the following chapters of the **ES [TR030008/APP/6.2]**:

a. **Chapter 9: Nature Conservation (Marine Ecology).**

b. **Chapter 16: Physical Processes.**

c. **Chapter 17: Marine Water and Sediment Quality.**

d. **Chapter 19: Climate Change.**

e. **Chapter 21: Ground Conditions and Land Quality.**

18.1.5 This chapter is also supported by the following figures **[TR030008/APP/6.3]** and appendices **[TR030008/APP/6.4]**:

a. **Figure 18.1:** Study Area.

b. **Figure 18.2:** Environment Agency Flood Map for Planning.

c. **Figure 18.3:** Risk of Flooding from Surface Water.

d. **Figure 18.4:** WFD Water bodies within ZOI

e. **Figure 18.5:** WFD Baseline Screening Sampling Locations

f. **Appendix 18.A:** Flood Risk Assessment.

g. **Appendix 18.B:** Drainage Strategy.

h. **Appendix 18.C:** Water Quality Sampling 2023

i. **Appendix 17.A:** WFD Screening Assessment (incorporates all WFD aspects).

18.2 Consultation and Engagement

18.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the water quality, coastal protection, flood risk and drainage assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on water quality, coastal protection, flood risk and drainage. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

18.2.2 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which formed part of the consultation.

18.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum formed part of the consultation.

18.2.4 A range of stakeholders were engaged as part of the scoping process to obtain their views on the Project and the scope of the water quality, coastal protection, flood risk and drainage assessment, the results of which are presented within the Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4]**).

18.2.5 Consultation has been undertaken with the following stakeholders to discuss any potential issues relating to water quality, coastal protection, flood risk and drainage:

a. Environment Agency

b. North-East Lindsey Drainage Board ("NELIDB")

c. Coal Authority

d. Natural England

e. Immingham Town Council

f. Lincolnshire Council

g. North East Lincolnshire Council ("NELC")

h. Crown Estate

i. The Port Authority

j. Marine Management Organisation ("MMO")

k. Anglian Water.

18.2.6 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultations and other pre-application engagement is summarised in **Table 18-1**. The full responses to consultation comments are included within the **Consultation Report [TR030008/APP/5.1]**.

Table 18-1: Consultation summary table

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Environment Agency	Paragraph 17.2.14 considers that the residual risk from overtopping or failure of defences is low and as a result, the potential impacts of this are given little weight in the remainder of the Report. The flood risk assessment will need to recognise that the probability of defence failure is not suitable for planning purposes; we would refer the Applicant to paragraph 024 of the recently updated Planning Practice Guidance (Flood risk and coastal change section) for further information on what is required in this respect. To help with considering the residual risk the Environment Agency has produced Coastal Hazard Mapping which covers the site (this is not referenced as a data source in paragraph 17.2.1). To obtain this information the Applicant is advised to make a formal enquiry to our Customers and Engagement team at LNenquiries@environment-agency.gov.uk. Please request a Product 3/8. There is no charge for this information. COMAH regulated sites are expected to consider the level of flood risk and appropriate resilience. This is set out in the Inspection of COMAH Operator Flood Preparedness delivery guide. The delivery of this is not specifically required within the EIA for planning purposes, but it will need to be considered as part of the pre-operation Safety Report. As such, it would be prudent to consider this alongside planning guidance on flood risk so that any additional mitigation standards, which may be required	Existing flood risk issues are considered in **Section 18.6** and the assessment of impacts and effects is detailed in **Section 18.8**. The Flood Risk Assessment ("FRA") which forms **ES Appendix 18.A [TR030008/APP/6.4]** assesses in detail the residual risk of flooding from overtopping and flood defence failure using the Coastal Hazard Mapping provided by the Environment Agency. The maximum breach flood water level for the 2115 0.5% AEP and 0.1% AEP events have been provided by the Environment Agency and have been used to inform mitigation measures for the Project. The Project is designed to meet the requirements defined under the COMAH regulations, including flood preparedness therefore a Pre-operation Safety Report is currently being undertaken. The assessment of physical processes is provided in **Chapter 16: Physical Processes [TR030008/APP/6.2]** and explains how geomorphology has been considered.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		during site operation (e.g. for the storage of hazardous substances), can be included from the outset. Although physical processes are considered in Chapter 17, we would also like to see a discussion (or cross-reference to any discussion in Chapter 15) regarding geomorphology resulting from said processes.	
	Anglian Water	There are significant existing Anglian Water assets including water mains along the south side of the site and within the roads to the north and east. Water recycling assets including rising mains also run to the south, east and north of the site. Maps of Anglian Water's assets are available to view at: www.digdat.co.uk	Noted.
		Anglian Water notes that the promoter identifies at Page 211 that surface water on site is managed by the Port of Immingham (17.2.21). We conclude from this that no surface water will be managed via the Anglian Water public sewer network. At 17.2.3 the promoter comments on the proximity of an Anglian Water 600mm foul sewer in proximity to the site boundary. The rising main on the southern edge of the site is 450mm, the sewers to the north and east of 300mm with connections of 150mm. These assets are part of and serve the wider Immingham Water Recycling catchment including the town of Immingham to the west.	Noted.
		We note that other than a reference to a ‘main water pipe’ (2.2.7) the promoter does not refer to	The presence of Anglian Water assets is noted and this information has been used to inform Project planning and design. Discussions with Anglian

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		the water supply network assets which run along Kings Road, Queens Road and the southern boundary of the site. Through consultation proposed in 17.7.1 Anglian Water would want to ensure the location and nature of these assets is identified and protected. To reduce the need for diversions and the attendant carbon impacts of those works, ground investigation would enable the promoter to design out these potential impacts and so also reduce the potential impact on services if construction works cause a pipe burst or damage to supporting infrastructure. This approach would accord with Project Objective C. at 2.4.2. The Scoping Report refers to Anglian Water assets and that: • the project relies upon a connection to the 'local sewer network' (21.4.7), • a potable water supply connection is required to a 'local main water network' (2.4.20) • a 'site wide cooling water system' is required (2.4.22) In view of the guidance in the National Policy Statements we would have anticipated that the scoping would have included and then considered the approach to water supply, water resources and water recycling assets. Anglian Water requests that these points are assessed early in the EIA to set out how the project will be supplied with water, its wastewater managed, how water assets serving residents and business will be protected and how design has been altered to reduce the need for	Water in relation to asset protection measures are ongoing. The development of protective provisions in respect of Anglian Water's interests is ongoing. Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter. Agreement has been reached in principle with Anglian Water for the provision of non-potable water to the required standards suitable for use in the site cooling towers for the hydrogen production facility, sufficient for the full project (Phases 1-6). This water is to be transferred to the site from an existing Anglian Water resource. The use of non-potable water for this application will reduce the pressure of the Project on an already water stressed Water Resource zone within the UK. The **Outline Construction Environment Management Plan** ("CEMP") for the Project accompanies the DCO Application **[TR030008/APP/6.5]**. The final CEMP would be prepared by the contractor, in accordance with the Outline CEMP, prior to commencement of construction and is secured by Development Consent Order ("DCO") requirement. The Outline CEMP confirms that a Water Management Plan would be prepared as part of the final CEMP.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		new water infrastructure or the diversion of existing assets. We support the inclusion of water (17.5.3) including water infrastructure in the Construction Environment Management Plan and Water Management Plan. The CEMP and a WMP should include steps to remove the risk of damage to Anglian Water assets from plant and machinery including haul roads. Further advice on minimising and then relocating Anglian Water existing assets can be obtained from: connections@anglianwater.co.uk The site is in the East Lincolnshire Water Resource Zone (WRZ), which supplies water to Grimsby the eastern parts of Lincolnshire WRZ and serves communities as far south as Boston. We note that whilst the scoping considers water environment impacts it does not look at water resources. As the site is within an area of 'serious water stress' designated by the Environment Agency and water is used in the project construction and operation this indicates that water resources should be assessed in the EIA, learning lessons from previous projects such as Sizewell C. This may include consideration of the Socio-Economic effects of the use of water for the project in the context of growth and climate change as well the potential impacts on communities and business if these services are distributed. There is no reference to assessment of the carbon costs of	

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		relocating water infrastructure if assets are impacted during construction or operation. Anglian Water notes that the applicant has not sought to scope these matters out by providing sufficient information to reach a conclusion that the projects impact regarding water supply as well as water recycling and water quality, are not significant.	
		Anglian Water would welcome the instigation of discussions with Associated British Ports as the prospective applicant, in line with the requirements of the 2008 Planning Act and guidance. Experience has shown that early engagement and agreement is required between NSIP applicants and statutory undertakers during design and assessment and well before submission of the draft DCO for examination. Consultation at the statutory PEIR stage would in our view be too late to inform design and may result in delays to the project. We would recommend discussion on the following issues: 1. Requirement for potable and raw water supplies 2. Impact of development on Anglian Water's assets including groundwater and water abstraction and the need for mitigation 3. Requirement for water recycling connections 4. The design of the project to minimise interaction with Anglian Water assets and specifically to avoid the need for diversions which have carbon costs	An assessment of the cumulative effects of the Project with other nearby development is presented in **Chapter 25: Cumulative and In-combination Effects [TR030008/APP/6.2]**. No proposed Anglian Water projects are identified on the Long List of developments for further consideration and no cumulative impacts are expected in relation to Anglian Water projects.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		5. Confirmation of the project's cumulative impacts (if any) with Anglian Water projects 6. Draft Protective Provisions	
	Planning Inspectorate	Paragraph 17.2.14 considers that the residual risk from overtopping or failure of defences is low. The Applicant's attention is drawn to the Environment Agency's consultation response and paragraph 024 of the Planning Practice Guidance (Flood risk and coastal change) which states that information on the probability of flood defence failure is unsuitable for planning purposes given the substantial uncertainties involved in such long-term predictions. The Applicant is advised to use the Environment Agency Coastal Hazard Mapping when considering residual flood risk and agree the detailed flood risk methodology and mitigation with the Environment Agency where possible.	The FRA which forms **Appendix 18.A [TR030008/APP/6.4]** assesses in detail the residual risk of flooding from overtopping and flood defence failure using the Coastal Hazard Mapping provided by the Environment Agency. The maximum breach flood water level for the 2115 0.5% AEP and 0.1% AEP events have been provided by the Environment Agency and have been used to inform mitigation measures for the Project.
		Paragraph 17.2.5 notes that tide-locking is an existing problem for Habrough Marsh Drain and North Beck Drain. The Inspectorate draws attention to concerns within the consultation response from North East Lindsey Drainage Board that offshore infrastructure in proximity to the gravity outfall of Habrough Marsh Drain could impede drainage. The ES should consider any likely impacts arising from the construction and operation of the offshore infrastructure on the function of drains outfalls and implications for flood risk onshore.	The Habrough Marsh Drain gravity outfall and the associated intertidal area is considered in **Chapter 16: Physical Processes [TR030008/APP/6.2].** The Chapter assesses the impacts of the marine development for both the construction and operation phases of the Project. **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*." Based on this assessment no impacts are predicted from the construction and

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			operation of the offshore infrastructure on the function of drains, outfalls etc, therefore any impacts on flood risk onshore are considered unlikely.
	North East Lindsey Drainage Board	The onshore part of the site is within the North East Lindsey Drainage Board area. Generally, the report contains appropriate references to North East Lindsey Drainage Board and the Board has already provided information to the consultants. An area of concern is the impact offshore. The proposals show new infrastructure in the Humber near to the gravity outfall of Habrough Marsh Drain, there is concern that this will result in siltation which will impede the discharge. The FRA should address this and put in place measures to mitigate it.	The Habrough Marsh Drain gravity outfall and the associated intertidal area is considered in **Chapter 16: Physical Processes [TR030008/APP/6.2].** The Chapter assesses the impacts of the marine development for both the construction and operation phases of the Project. **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*." Based on this assessment no likely impacts are predicted from the construction and operation of the offshore infrastructure on the function of drains, outfalls etc, therefore any impacts on flood risk onshore are considered unlikely. No additional mitigation measures are required.
Statutory Consultation January 2023	Anglian Water	Can you advise when Anglian Water will be provided with information on the water demand requirements for the project?	Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter**.**
		Anglian Water had decided to bring the planning liaison for the IGET project back in house given the potential demand for and possible impact on water resources.	Noted.
		There are significant existing Anglian Water assets including water mains along the south side of the site and within the roads to the north and east. Water recycling (sewerage) assets, including rising mains, also run to the south, east and north of the	The presence of Anglian Water assets is noted and this information has been used to inform Project planning and design. The Applicant can confirm that protective provisions for relevant AWS assets are included in the draft Development Consent Order ("DCO")

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		site. Anglian Water understands as of 31 January 2023, no diversions are required by the project. The protection of existing infrastructure through stand-off distances (e.g.) and the process for agreeing diversions will be required to be set out with Protection Provisions (PPs) and Requirements in the draft DCO order. The draft DCO should be agreed with Anglian Water's team in advance of submission of the application to the Planning Inspectorate.	**[TR030008/APP/2.1]** and summarised in the **Utilities Statement [TR030008/APP/7.7]**. Air Products is actively working with AWS to agree a statement of common ground.
		Anglian Water welcomes the approach by the project in 2022 seeking advice on a new water connection. Anglian Water identified that through the development of statutory Water Resources Management Plan (WRMP) that there was insufficient water supplies available to meet the new and expanded water demands from planned non-household projects in the South Humber cluster. The regulatory position is that non-household demands are not permitted to jeopardise domestic supplies to households. Air Products have sought confirmation on the availability of 3.5 Ml/d of non-potable water for the project. The water is currently available although we understand that Air Products aren't currently in a position to enter into a contract to secure this maximum daily demand. Air Products have been made aware that the headroom may not be available at a later date. Total housing growth across the WRZ is forecast to be 16% over the 25 years to 2050, resulting an	Noted. Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter. The needs for potable supplies are small and will not have an impact on potable supplies for the region. Air Products is actively working with Anglian Water to agree a statement of common ground on these matters including for foul water connection.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		increased population of 432,800 people by 2050. Anglian Water's WRMP indicates that household demand reduces from 56.1 Ml/d to 55.8 Ml/d in 2050 (Dry Year Annual Average) even accounting for the increase in population. However, by this measure and without interventions, the WRZ is forecast to go into deficit by 2040. Demand management including smart metering is forecast to reduce average per capita consumption from 134.9 l/d to 112.0 l/d in 2050. With demand management, total demand is forecast to be 95.4 Ml/d. In our draft WRMP, NHH demand (Dry Year Annual Average - DYAA) was forecast to change from 32.7 Ml/d to 32.2 Ml/d in 2050. This 2022 forecast did not include the project's water demands or that of other hydrogen, carbon capture or low carbon economy projects. Cuts in household demand and a flat NHH demand meant that abstraction reductions to protect the environment could be delivered with an overall supply demand balance in the WRZ (DYAA). In our Scoping response Anglian Water noted that whilst scoping considered water environment impacts, it did not look at water resources. As the site is within an area of 'serious water stress' designated by the Environment Agency (EA) and water is used in the project construction and operation, Anglian Water directed that water resources should be assessed in the EIA. The reductions in available water supply coupled with the likely environmental impacts of continuing to	

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		abstract from current sources or to construct and utilize new sources such as desalination as 'upstream' effects mean that the project EIA is required to assess these likely significant effects. Anglian Water would want to work with the project to ensure this assessment is appropriate and dovetails with our WRMP and if required, DWMP process. For example, one solution may be to utilize final effluent (FE) from water recycling (sewage) works as a feedstock for the project or other new uses and so provide either raw water or potable water to projects whose technical requirements limit its supply to non-FE sources. The project timeline proposing submission in summer 2023 means that the NSIP is ahead of Anglian Water's WRMP (and DWMP) timelines which would only provide certainty of water supply and options such as non-potable or final effluent supply in 2024 following Regulator sign off. It may be possible through collaborative working with the project to put in place agreements including MDD which provide sufficient certainty for the Examining Authority as advised by the EA and others in Spring 2024 such that, subject to regulatory approval the Secretary of State in making their decision in or about Winter 2024, would be cognisant of approval of Anglian Water's WRMP (and DWMP). If that were not possible, then water supply options may need to be considered outside of the economic regulatory framework which introduces additional commercial and environmental uncertainties. Those solutions may	

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		also involve a significantly higher carbon footprint if new infrastructure is required which would be contrary to the project's and UK decarbonization policy.	
		Anglian Water supports the project's objectives and to make 'effective use of available land, water, transport and utility connections', and to enhance the 'local and regional economy' as these align with our company articles to support environmental and social prosperity in the region and our focus on being net zero by 2030. We note that the Terminal description includes disposal of wastewater and so Anglian Water will need to undertake an assessment of the quantum of wastewater requiring treatment via the public sewer network to assess network and treatment capacity, as so inform the project design and the relevant sections in the EIA. Whilst Anglian Water pipeline diversions in roads and adjacent land may not be necessary, the project is able to meet the required standoff distances in project design, construction and operation including retaining suitable easements to access water infrastructure.	The Project's sewerage requirements in respect of the number of users were provided to Anglian Water at an early stage. Similarly the requirements of the Project in respect of cooling water blowdown wastewater treatment, which would drain to the foul sewer, have been shared with Anglian Water. Air Products is actively working with Anglian Water to agree a statement of common ground.
		Anglian Water welcomes the inclusion of water in the list of environmental impacts to be assessed, minimized, and mitigated. This will also assist the local Councils, MPs, community and businesses to be assured that water supply for domestic and existing customers won't be jeopardized and the	Noted

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		abstraction of water and management of wastewater does not degrade the environment.	
		Anglian Water supports the reference to other projects as the cumulative impact of the projects including their need for water supplies and wastewater treatment can be assessed to seek to future proof the environmental gains from the transition to a low carbon economy.	Noted
		Anglian Water would want to ensure that water and wastewater are considered within the final EIA and this assessment includes consideration of Anglian Water and related parties such as the EA advice and solutions.	Further detail on the Project's water supply and wastewater requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter**.** The requirements and proposed connection points are covered in the **Utilities Statement [TR030008/APP/7.7]**.
		Anglian Water recognises the potential locational advantages of Immingham including CCS. We are not in a position now to advise whether alternative locations or technologies would be more sustainably located to supply the required quantum of water or whether required regulatory approvals would be forthcoming to serve the site or would be more sustainable and viable for the environment and customers in alternative locations. For example, larger scale hydrogen facilities proposed elsewhere in the UK may have more sustainable access to water supplies. The spatial options for water resources may be an appropriate mater for forthcoming National Policy Statements which themselves may be guided by the recently	Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter**.** A commercial offer has been made by Anglian Water to provide a sub-potable supply of water from a non-potable water main within Laporte Road. This water will originate from an existing Anglian water source with capacity and will be water will be transferred to the site for use within via a non-potable water main. Applicant and Air Products has water efficiency as one of its five top objectives for the project. The use of all economically viable methods to support regional water resources is acknowledged. The Applicant can confirm that protective provisions for relevant Anglian Water assets are included in the draft DCO and summarised in the utilities statement.

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		launched National Infrastructure Commission NPS review. We note the timeline (Table 3.2) for the Green Hydrogen Production Facility indicating that construction would be determined by market demand and would take from 3 to 11 years to build out capacity. Build out and operation of one hydrogen production unit by year 3 and a second by year 5 would potentially limit Anglian Water's ability through the WRMP to supply water (and/or wastewater recycling capacity) to meet those new demands in 2025 to 2030 (the AMP8 regulated investment cycle). Anglian Water has sought throughout engagement to flag the potentially critical issue of water supply to the project. We again advocate that the water supply and related wastewater topic is considered against the process set out in 5.1.2. Given the fortuitous timing of the WRMP and DWMP and supporting SEA, the project could consider the new baseline and future position up to 2050 in the project EIA including HRA and other assessments. The impact of curtailed water supply to domestic customers could also be assessed including consideration of the Socio-Economic effects of the use of water for the project in the context of growth and climate change as well as the potential impacts on communities and business	Air Products is actively working with Anglian Water to agree a statement of common ground on these matters including for foul water connection.

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		The impact of water supply provision to the project (and wastewater) on nature is not evident in the summary. For example, should this not include the potential impact from increased abstraction of water from groundwater sources within the port. This then may indicate that water sources from elsewhere have the potential to be less damaging on ecology. Similarly, the impact from wastewater particularly on marine ecology should also be summarized in the PEIR. This then enables the subsequent full EIA to consider those impacts and effects and advise on whether those upstream impacts have a level of significance requiring mitigation.	No abstractions from groundwater are proposed for this development and no related impacts on ecology are anticipated. The impacts of the Project on marine receptors are addressed in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** and **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**.
		Anglian Water welcomes the inclusion of the impact of the project on water bodies, groundwater etc – including those utilized for water supply – in Chapter 18. The Chapter as currently headed Water Quality does enable consideration of the impact of the water demands of the project through the lens of Water Quality. We suggest however that the Chapter is called Water Supply, Water Quality, Coastal Protection, Flood Risk and Drainage to ensure the end to end consideration is captured.	The chapter title has been expanded to include Water Use.
		We recognize that further work is needed by the project with Anglian Water and the Environment Agency when considering out current draft WRMP consultation to bring forward solutions that enable a similar conclusion to be reached on the	Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter**.**

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		magnitude of the residual impacts from water supply and wastewater management. That assessment should include the carbon costs of water and wastewater infrastructure. This assessment may equally be considered in Chapter 19: Climate Change. At this point it is important to re-state that Anglian Water is committed to being net zero by 2030. The draft nature of the WRMP and DWMP means that any solutions to water supply or wastewater are not at a stage which could be considered as reasonably foreseeable future projects. The water demands and wastewater requirements of known projects such as the Immingham RoRo or CCS projects can though be assessed in Chapter 25. The domestic water supply and wastewater position and on-household trajectory without factoring these projects can be drawn from the draft WRMP and DWMP. It is probable that the water supply assessment in Chapter 18 will be a Significant Effect. This may require consideration to interim solutions which require further regulatory decisions where the outcome of which cannot be certain. If the project, working with Anglian Water, despite the national importance of hydrogen for decarbonization and net zero, could not secure such decisions, then the project would need alternative options which themselves may constitute an NSIP. As set out above, the key issue for the project is the impact of local water resources, which the	Applicant and Air Products has water efficiency as one of its five top objectives for the Project. The use of all economically viable methods to support regional water resources is acknowledged. A commercial offer has been made by Anglian Water to provide a sub-potable supply of water from a non-potable water main within Laporte Road. This water will originate from an existing Anglian water source with capacity and will be water will be transferred to the site for use within via a non-potable water main. The Applicant can confirm that protective provisions for relevant Anglian Water assets are included in the draft DCO and summarised in the utilities statement. Air Products is actively working with Anglian Water to agree a statement of common ground on these matters including for foul water connection.

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		PEIR at 18-4 advises: "Water requirements will be discussed with Anglian Water in order to determine Project impacts on local water resources. Potential Project impacts will be reported in the ES'.	
		On the question of a 'local sewer network' (18-3) connection, the PEIR is silent. Given the potential for water recycling to be part of the solution for water supply to the project including greywater and rainwater harvesting for site operatives to use, Anglian Water looks forward to resolving the question of sewer network connections with the project. With reference to 18.4.18 and 18.4.19, the project may conclude that no connection is required to Anglian Water's sewer network. We would anticipate that a detailed Drainage Strategy would be a matter for a post consent requirement approval by the LPA and that AW would be a consultant if any connections including surface water were proposed to the public sewer network.	A **Drainage Strategy** has been prepared and forms **Appendix 18.B [TR030008/APP/6.4]**. There is no plan to discharge surface water to the sewer network. There is a robust ditch network around and through the site which would be used as a discharge location (see rows below).
Statutory Consultation January 2023	North East Lindsey Drainage Board	The site is within the NELIDB area. The Board maintained Habrough Marsh Drain is on the Northwest of the site. The surface water catchment of the site discharges three ways. Northwest into the Board maintained Habrough Marsh Drain (8) gravity system. Southwest into the Board maintained Immingham 2 Pumping Station system.	A **Drainage Strategy** has been prepared and forms **Appendix 18.B [TR030008/APP/6.4]**. The Drainage Strategy has been produced in consultation with NELIDB which is secured by DCO requirement. The Applicant is in discussion with the North East Lindsey Drainage Board about disapplication of the land drainage consent within the DCO. See Article 3 of the **draft DCO [TR0300008/APP/2.1].** Access to Parcel 55 will be maintained as part of the Project design. The Drainage Strategy in **Appendix 18.B [TR030008/APP/6.4]** is an outline strategy at this time with detailed design being undertaken at the detailed design stage.

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		Northeast into Stallingborough North Beck. The watercourse is an Environment Agency main river, an Environment Permit (from the Environment Agency) will be required for any works within Byelaw distance and discharge outfall(s). Any surface water discharges into the drainage systems to be attenuated to an agreed rate. As a brown field site the surface water discharge into the Boards drainage systems from any re-development will be expected to be reduced to 70% of the existing 'actual' discharge rate via any discharge points or routes. It is essential a full survey is undertaken to establish the existing surface water drainage system, catchments and current discharge rates. Under the terms of the Board's Byelaws, the prior written consent of the Board is required for any proposed temporary or permanent works or structures in, under, over or within the byelaw 9m distance of the top of the bank of a Board maintained watercourse, Habrough Marsh Drain (8). Under the terms of the Land Drainage Act. 1991 the prior written consent of the Board is required for any proposed temporary or permanent works or structures within any ordinary watercourse including infilling or a diversion. An area of concern is the impact off shore. The proposals show new infrastructure in the Humber near to the gravity outfall of Habrough Marsh Drain, there is concern that this will result in siltation which will impede the discharge. The	The gravity outfall of the Habrough Marsh Drain has been considered in the assessment set out in **Chapter 16: Physical Processes [TR030008/APP/6.2]**. The outputs from this assessment have been used to inform the FRA and this chapter. **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*." Based on this assessment no likely impacts are predicted from the construction and operation of the offshore infrastructure on the function of drains, outfalls etc, therefore any impact on flood risk onshore is considered unlikely. No additional mitigation measures are required.

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		Flood Risk Assessment should address this and put in place measures to mitigate it. With regard to the land owned by the NELIDB a land interest questionnaire was returned on 16th November 2016. The land is adjacent to Parcel 55 which is the A1173. If the access to the Board's land is affected it is essential the Board is contacted to discuss and agree future access arrangements. [**Note:** These points were restated verbatim by NELIDB in response to the second Statutory Consultation. Additional comments made in that response are covered in rows below]	
Statutory Consultation January 2023	Canal & River Trust	Given the location of the project and the relationship of the proposal with our network, we do not believe that the proposals as shown would impact our interests. Should the scheme be amended to potentially affect our navigations, we could welcome further consultation on the proposals so that we can advise about any potential impact for our network.	Noted: The Project is not located in close proximity to any Canal and River Trust Assets.
		The Louth Canal is not owned or managed by the Trust. However, the Trust supports the preservation, conservation and protection of inland waterways for the public benefit. We recommend that you correspond with the Louth Navigation Trust regarding your proposal, and we advise that consideration is given to any response from the	A consultation response was requested from Louth Navigation Trust, however a response has not been received.

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		LNT on any impact that the proposal may have on LNT's preservation and regeneration objectives.	
Statutory Consultation January 2023	Environment Agency	Paragraph 2.3.41 – we would point out that in addition to the tidal flood risk explained in this section, the site is also at risk of fluvial flooding. The site lies adjacent to the Stallingborough North Beck Main River and flood levels from this system should inform the flood risk assessment (FRA), ensuring that there is no increase in flood risk to third parties as a result of the development proposals. The project site falls within Flood Zone 3, which is land defined as having a high probability of flooding. The National Planning Policy Framework and National Policy Statement EN-1 states that an FRA must be submitted when development is proposed in such locations, and we welcome the further pre-application discussions that you are undertaking with us on the scope and requirements of this. The FRA should identify and assess the risks from all sources of flooding, to and from the development including residual risk. The FRA must demonstrate how these flood risks will be managed to ensure that the development remains safe throughout its lifetime, taking climate change into account, without increasing flood risk elsewhere and where possible reducing flood risk overall. The FRA will also need to address how flood risk will be managed during construction, to ensure the existing continuous flood defence wall height and integrity are maintained throughout,	The FRA (**Appendix 18.A [TR030008/APP/6.4]**) assesses in detail the risk of fluvial flooding from North Beck Drain and the results are summarised at **Section 18.6** in this chapter. The hydraulic modelling outputs from the 2020 Stallingborough & Oldfleet Model, provided by the Environment Agency, were used in the assessment. The FRA confirms that there would be no increase in flood risk from the North Beck Drain Main River to third parties as a result of the Project. The FRA which forms **Appendix 18.A [T0R30008/APP/6.4]** has been undertaken in accordance with the requirements of the National Policy Statement for Ports ("NPSfP") and the National Planning Policy Framework ("NPPF"). The FRA identifies and assesses flood risk from all sources to and from the development both for the existing baseline and taking into account climate change over the lifetime of the development. Mitigation measures are included at **Section 18.7** to manage flood risk associated with the Project. The design of the jetty access road where it passes over the flood defences includes sufficient space for the flood defences to be improved and the defences along the landside frontage, beneath and in close proximity to the jetty access road crossing, will be replaced by a new section of flood defence wall with a crest height of 7.0m AOD during the construction phase of the Project. Construction would be undertaken in such a way that the integrity of the flood defences would not be compromised] The Applicant is in discussion with the Environment Agency about disapplication of the flood risk activity permit. See Article 3 of the **draft DCO [TR0300008/APP/2.1]**.

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		and the risks associated with the crossing of the tidal/sea defence are included.	
		The PEI Report refers to the National Policy Statement for Ports which states “Port development is water-compatible development and therefore acceptable in high flood risk areas”. However, we understand the site will also require a Hazardous Substance Consent (ref PEI Report, Chapter 4, Paragraph 4.6.5) and Annex 3 of the NPPF: Flood risk vulnerability classifications, advises that such installations should be classified as ‘Essential Infrastructure’. The vulnerability of the development should be confirmed and include any additional mitigation measures that may be necessary, resulting from this. In Flood Zone 3a, ‘Essential Infrastructure’ should be designed and constructed to remain operational and safe in times of flood.	Although the National Policy Statement for Ports states "Port development is water compatible development and therefore acceptable in high flood risk areas" the FRA appended at **Appendix 18.A [TR030008/APP/6.4]** confirms that the development vulnerability classification of “Essential Infrastructure” is applicable to the landside Hydrogen Production Facility, based on the requirement for Hazardous Substance Consent. The required mitigation measures are outlined in the FRA appended at **Appendix 18.A [TR030008/APP/6.4]** and are summarised in **Section 18.7** of this chapter. It should be noted however, given the nature of the Project, there is no requirement for the Site to remain *operational* should a flood event occur. However, the Project is designed in such a way that it would remain *safe* over the lifetime of the development.
		The PPG has recently been updated with a suggested lifespan for non-residential development and recommends working on an assumed 75-year lifetime. In addition, it mentions that some major infrastructure projects may be expected to have development lifetimes beyond 100 years and should be assessed for a longer period of time. We request that the FRA clearly states the expected lifetime for the development elements (the landside development, the marine infrastructure, plant or equipment on the jetty topside etc.) and includes the appropriate	The design life of the landside development (the hydrogen production facility) is 25 years but the terminal (the jetty and related topside infrastructure) would become part of the permanent port infrastructure and refurbished accordingly as required. This and the approach to decommissioning is explained in greater detail in **Chapter 2: The Project [TR030008/APP/6.2]**. The FRA, at **Appendix 18.A [TR030008/APP/6.4]** uses the suggested 75 year lifespan for non-residential development, as outlined in the updated PPG, when assessing flood risk from fluvial, tidal, surface water/drainage system sources. The residual risk of flooding to the site should a breach in the flood defences occur is assessed against the 2115 0.1% AEP depth/velocity/hazard mapping for a breach event scenario and further

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		assessment to reflect this, along with decommissioning expectations/plans and information on how this will be secured in the DCO.	water level information for this event has been used to inform mitigation measures, where required. This provides a conservative approach to the assessment of flood risk.
		Although Chapter 4 (paragraph4.4.3) states that the "relevant NPS that applies to this Project is the National Policy Statement for Ports", Chapter 18 (paragraph 18.3.6) acknowledges that the FRA will be prepared in accordance with the Overarching NPS for Energy (EN-1). Accordingly, it is our view that the assessment of climate change should include consideration of a maximum credible scenario (EN-1 paragraph 4.8.8).	The Maximum Credible Scenario, as outlined in the Environment Agency updated Flood Risk Assessments: Climate Change Allowances guidance (Ref 18-13) has been included in the assessment of climate change for fluvial and tidal sources within the FRA as a sensitivity test for the worst case climate change scenario.
		An area of concern for us is maintaining continued access to the flood defence northwards of the jetty. We will look to maintain continued access to this area with you, secured through an appropriate mechanism. Whilst sufficient headroom could be made available for most maintenance operations, the need to use a larger plant would be restricted if an alternative access from Associated British Port's land is not secured as part of this DCO (e.g. as and when the defences have to be adapted in the future to counter the growing risk of tidal overtopping and flooding). Access to Stallingborough North Beck and the outfall must also be maintained.	The design of the jetty access road where it passes over the flood defences includes sufficient space for the flood defences to be improved and the defences along the landside frontage, beneath and in close proximity to the jetty access road crossing, will be replaced with a new section of flood defence with a crest height of 7.0m AOD during the construction phase of the Project. Construction would be undertaken in such a way that the integrity of the flood defences would not be compromised.

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		There should be no unadaptable development within 15.0 m of the landward toe (plus width for any existing soak dye) of the sea defences to allow for future improvements. Sufficient details should be provided on the works close to and over the existing defences and main rivers to give us the confidence that the required flood defence function will not be compromised at any time during the construction process. We welcome the continued pre-application engagement with ABP in respect of the works close to and over the existing defences and main rivers.	
		Paragraphs 18.4.6 and 18.4.10 – we would point out that the standard of protection of coastal assets takes account of wave height and an allowable overtopping rate. Tables 18.8-10: The effect of Minor/Moderate adverse for Humber Estuary (Tidal flooding- medium) and tidal flooding could be greater as hazard mapping shows a significant number of residential properties within the breach flood cell. Further review and consideration should be given to this effect.	These factors have been reviewed and taken into consideration in the FRA, at **Appendix 18.A [TR030008/APP/6.4]** and as relevant in this chapter at **Section 18.4.**
		Paragraph 18.1.14 – we note that the "water resource needs for the Project have not yet fully been quantified, but a source of water for cooling purposes, fire water for emergencies and a source of potable water would be required". The EA recently carried out work to explore the needs of industry and the impacts on the water environment of proposed technologies for carbon capture,	Further detail on the Project's water supply requirements is provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter**.** Agreement has been reached in principle with Anglian Water for the provision of non-potable water to the required standards suitable for use in the site cooling towers for the hydrogen production facility, sufficient for the full project (Phases 1-6). This water is to be transferred to the site from an existing Anglian Water resource. The use of non-potable water for

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		storage, and hydrogen production in the net zero industrial clusters. The Humber Industrial Cluster was chosen for a pathfinder project and the results of this showed that water resources need to be recognised as a limiting factor. We would urge you to undertake sufficient assessment work to provide you with the confidence that water resources will be able to satisfy your project's requirements. We also note that in response to the Scoping Report (Table 18.1) Anglian Water Services raised this issue and recommended the need for discussions on: · Requirement for potable and raw water supplies; · Impact of the development on Anglian Water's assets including groundwater and water abstraction; and · Requirement for water recycling connections If a new source of water or additional water from an existing source is being considered, the EA must be contacted at the earliest opportunity to discuss water availability and abstraction licensing agreements.	this application will reduce the pressure of the Project on an already water stressed Water Resource zone within the UK.
		Section 18.4 – In addition to the baseline conditions currently identified, Magic Map Application identifies North Beck Drain as a High Certainty chalk river and identifies a number of drains near the proposed site as Low Certainty chalk rivers. MagicMap details that chalk rivers are recognised as a priority habitat for protection under the UK Biodiversity Action Plan. The North Beck	The status of the North Beck Drain has been reviewed and taken into consideration in this chapter and also in the **WFD Compliance Assessment** appended at **Appendix 17.A [TR030008/APP/6.4]**. The designations on Magic Map do not appear to take account of the presence of Boulder Clay (glacial deposits) and Alluvium (estuarine deposits) both of which will sit upon the Chalk aquifer. The local geology limits the surface connectivity with the underlying groundwater.

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		Drain was raised during a meeting between consultants, AECOM and the EA on 17 November 2022 and it was highlighted that the Project could potentially cause deterioration, which in turn would reduce the scope for any further improvements of the North Beck Drain – the meeting organiser recorded this as an action for further consideration.	
		We note that a Water Framework Directive assessment will be undertaken (mentioned in paragraph 18.3.5) to determine whether the project complies with the objectives of the WFD. We look forward to reviewing this in due course.	The **WFD Compliance Assessment** is appended at **Appendix 17.A [TR030008/APP/6.4].**
		NELIDB need to be part of this consultation as the surface water drainage for the site is reliant on their infrastructure. However, I believe that they will have been consulted directly by ABP along with the MMO and EA… The newer higher 40% climate change allowance should be used within the drainage design on the site. An assessment on the exceedance routes should be undertaken on storms over and above the design 1:100 year plus climate change scenario. We will need to see a drainage strategy for the development at this current stage to agree the principals of the design before the detailed design starts.	A **Drainage Strategy** has been prepared and forms **Appendix 18.B [TR030008/APP/6.4]**. The Drainage Strategy has been produced in consultation with NELIDB which is secured by DCO Requirement.

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Statutory Consultation January 2023	North East Lincolnshire Council	The site will have to discharge at greenfield rates to manage flood risk, the final discharge rate will be agreed with NELIDB. SuDS will have to be utilised across the development to manage surface water and help improve water quality. Water quality is key in this area due to all the habitat designations in the Estuary. SuDS can help to deliver the Biodiversity Net Gain requirements in addition to the flood risk management function. We will need to see a drainage strategy for the development at this current stage to agree the principals of the design before detailed design starts.	A **Drainage Strategy** forms **Appendix 18.B [TR030008/APP/6.4]** and identifies the SUDS measures used to meet the discharge rates agreed with NELIDB. Locations of high contamination potential would be bunded and would not impact the surface water drainage system. The areas draining into the system are not expected to generate significant contamination and the combination of gravel storage areas and swales/ditches is expected to provide sufficient treatment.
		The Applicant should investigate ways to re-use surface water on the site to make use of surface water if feasible.	Further detail on the Project's water supply requirements are provided in **Chapter 2: The Project [TR030008/APP/6.2]** and also at **Section 18.7** in this Chapter. Arising from discussions with Anglian Water, a commercial offer has been made to provide a non-potable supply of water from a non-potable water main within Laporte Road. This water will originate from an existing Anglian water source with capacity and will be water will be transferred to the site for use within via a non-potable water main. The re-use of surface water for operational use is not considered viable because it in the absence of large storage volumes, which are not possible within a limited site area, this possible source would not provide a sufficiently reliable supply.
		With the site being on the floodplain, any rising of ground levels will displace water elsewhere, if the project requires raised levels, compensatory	The Environment Agency Flood Map for Planning shows the Site is located in Flood Zone 3a (tidal) when the tidal flood defences are not accounted for. The Site benefits from the presence of flood defences up to and including the 0.5% AEP flood event, therefore the actual risk of flooding to the Site

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		storage will be required elsewhere, so that flood risk is not increased in the surrounding area.	from tidal sources is low. However, there remains a residual risk of flooding should there be overtopping or a breach in the flood defences. This is considered further in the FRA and in **Section 18.8** of this chapter. Compensatory storage is not required to mitigate for residual *tidal* flood risks, (but might have been required if the Project had been located within the *fluvial* Flood Zone 3 extent).
		The newer higher 40% climate change allowance should be used within the drainage design on the site. An assessment on the exceedance routes should be undertaken on storms over and above the design 1:100 year plus climate change scenario.	The **Drainage Strategy** that is provided at **Appendix 18.B [TR030008/APP/6.4]** includes the higher 40% climate change allowance within the conceptual drainage design. The Strategy also assesses exceedance flow routes for storms over and above the 1:100 year plus climate change scenario.
		The flood risk implications of the IGET Project are also not assessed adequately in the consultations documentation, with the preliminary information stating that a full Flood Risk Assessment is to be submitted at a later date. Given the Plant and Order Land's location adjacent to the Humber, and noting the ongoing effects of climate change, the risk of flooding affecting our operation is significant. We will require comfort that the risk of flooding at both the Order Land and the Plant will not be heightened by the IGET Project.	The FRA, at **Appendix 18.A [TR030008/APP/6.4]** considers the risk of flooding from all sources to and from the Project over the lifetime of the terrestrial elements of the development in accordance with both the National Policy Statement for Ports and the National Planning Policy Guidance. Mitigation measures are described in **Section 18.7** of this chapter which would minimise the risk of flooding and to ensure the development remains safe. The FRA also assesses the impact of the Project on flood risk, particularly from tidal, fluvial and surface water sources. The FRA and the summary provided below at **Section 18.8** of this chapter concludes that given the presence of the tidal flood defences, which would be raised by the Environment Agency in line with flood management plan proposals in order to maintain the standard of protection along the Humber Estuary in this area, the Project is considered to be at low risk of tidal flooding. It is unlikely, given the extent and depth of flooding along the South Humber Bank should a breach occur, that the Project would increase the risk of flooding off-site to surrounding land over its lifetime as these areas would

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			be flooded to the same depth as the Site. Any increase in flood water level is likely to be insignificant. The Drainage Strategy **Appendix 18.B [TR030008/APP/6.4]** outlines how surface water generated on site would be managed so that the risk of surface water flooding does not increase over the existing scenario.
Statutory Consultation January 2023	Polynt Composites	Concern about the impact to the water table and compensation due to increased risk of flooding	The response provided in the row above addresses the concern raised.
Statutory Consultation January 2023	Local Resident (living within approx. 10km of the project)	Change No. 3: Routing of pipe-rack & Jetty Access Road in the 'Long Strip' woodland It is essential provision is made to allow for maintenance access adjacent to all watercourses within or adjacent to the site. An unobstructed strip of suitable width should be left adjacent to the watercourse to allow for maintenance by suitable plant. The summitted plans are not clear enough to determine if suitable access has been left.	The existing small drainage channel that runs along the western edge of the Long Strip woodland within proposed Work No. 2 would be cleared of vegetation and re-lined to ensure its effective drainage function. The available flow area of the channel will be maintained and even improved by the removal of vegetation. The Applicant would undertake ongoing maintenance of the drainage channel.
Statutory Consultation May - June 2023	North East Lindsey Drainage Board	Change No. 4: West Site layout, elevations and drainage It is noted land is proposed to be raised from 0.5m to 2.5m, the Board is concerned that any potential land raising within the flood plain (zone 3 on the Environment Agency Flood maps). The residential area of Immingham is within the catchment and loss of flood plain volume is likely to increase flood risk. Also there can be a negative impact of third	For the West Site, existing ground elevations range from the highest point of 3.0m AOD at the north-east corner, to 2.0m AOD at the lowest point in the south-west corner. The finished ground level of the West Site, in which Work No. 7 would be constructed, would be approximately 2.5m AOD. The levels are required to ensure the site can drain adequately (see also the **Appendix 18.B [TR030008/APP/6.4]**. The finished ground levels for the Project are covered in **Chapter 2: The Project [TR030008/APP/6.2].** As explained in **Section 18.8** of this chapter the risk of flooding to the Site is predominantly from tidal sources. The designation of the West Site in Flood Zone 3 on the Environment Agency FMfP does not take in to account the

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		parties by acting as a dam, diverting surface water flows and locally lifting ground water levels.	presence of the tidal flood defences. With the defences in place the risk of flooding to the Site is low. The Site is at residual risk of flooding should overtopping or a breach of the flood defences occur. Should a breach or overtopping of the defences occur the South Humber Bank, including the Project, would be inundated. Given the extent of flooding, any increase in flood water level in surrounding areas due to the level increase, is likely to be insignificant. Mapping of fluvial flood extents (as provided in the NELC PFRA (Ref 18-16) shows the Project is located in Flood Zone 1 (low risk) and analysis of the Environment Agency RoFSW mapping (Figure 18.3) shows only small areas of surface water flooding from low to high risk associated with topographical low spots and constrained to watercourse corridors. Given the location of the Project in an area of low fluvial risk (Flood Zone 1) there would be no loss of floodplain storage and no negative impact on third parties. The Drainage Strategy (**Appendix 18.B [TR030008/APP/6.4]** includes provision of attenuation storage for surface water over the lifetime of the development and restricts surface water run-off to less than currently drains to the local watercourses so would provide betterment over the current scenario.
		Second Statutory Consultation Update since 16 March 2023 (Air Products meeting with AW) – agreement with EA for supply of up to 60 Ml/d of water for South Humberside decarbonisation projects. These plans have been incorporated into the draft WRMP 2025-50 which will be submitted to OFWAT later this year. Their response notes the efficient use of water and utility connections are part of key objectives for the	The commercial offer received from Anglian Water over the supply of resources, means that no further assessment is required of any impacts associated with water demand or supply, including any environmental impacts which might be associated of the provision of resources including any new abstractions. Anglian Water as part of their Water Resources Management Planning (WRMP24) process would have made their own assessment in order to give this response. The offer now received from Anglian Water (dated 27 July 2023) for a non-potable supply is in excess of that required for the IGET project Phases 1 to 6.

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		project. Refs Non-Domestic Water Demand Position (tbc); under which applicants will be required to work with them to produce a Water Resources Assessment as part of the EIA for the project – to be updated through the Examination process as the WRMP process progresses. Engagement with AWS as the water and sewerage undertaker is acknowledged and the Wave as the prospective water retailer is acknowledged. From the PIER addendum, AW acknowledges the ground raising in the west of the site and the aim to not increase flood risk at lower elevation. Confirmation that drainage and runoff does not pose a hydrological risk to their underground assets is requested and to be contained in Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage.	The Drainage Strategy (**Appendix 18.B [TR030008/APP/6.4]**) includes provision of attenuation storage for surface water over the lifetime of the development and retains surface water on the West Site up to the 1% AEP plus 40% climate change event. Discharge rates from the West Site are restricted to the greenfield runoff rate and surface water is discharged to the Immingham Pump Drain via a local land drain to the south of the Site, providing betterment over the current scenario. Drainage and runoff should therefore not pose a hydrological risk to AW underground assets.
July 2023	Anglian Water	Thank you for the opportunity to comment on the above application. The site is within the North East Lindsey Drainage Board area. The Board maintained Habrough Marsh Drain (8) is on the Northwest of the site. Below are comments on the revisions. Change No. 3: Routing of pipe-rack & Jetty Access Road in the 'Long Strip' woodland It is essential provision is made to allow for maintenance access adjacent to all watercourses within or adjacent to the site. An unobstructed strip of suitable width should be left adjacent to the	Current proposals show the pipe-rack and Jetty Access Road are located to the east of the land drainage ditch in the Long Strip woodland. The channel of the land drainage ditch will be cleared of vegetation and the remains of the old concrete liner will be removed and replaced by a new concrete lined channel. The drainage ditch will be overlaid by grating along its length to allow for an access corridor for inspection/maintenance of the pipe-rack. The grating allows the open nature of the watercourse to remain rather than being fully culverted along the channel. The Applicant would undertake ongoing maintenance along the land drainage ditch, with access possible from the access road/ adjacent pipe rack area.

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		watercourse to allow for maintenance be suitable plant. The summitted plan are not clear enough to determine if suitable access has been left.	
Secondary Statutory Consultation May 2023 – July 2023	North East Lindsey Internal Drainage Board	Change No. 4: West Site layout, elevations and drainage It is noted land is proposed to be raised from 0.5m to 2.5m, the Board is concerned that any potential land raising within the flood plain (zone 3 on the Environment Agency Flood maps). The residential area of Immingham is within the catchment and loss of flood plain volume is likely to increase flood risk. Also there can be a negative impact of third parties by acting as a dam, diverting surface water flows and locally lifting ground water levels. The Board has previously commented on the project directly and to the DCO, these comments below remain valid. The surface water catchment of the site discharges three ways. 1. Northwest into the Board maintained Habrough Marsh Drain (8) gravity system. 2. Southwest into the Board maintained Immingham 2 Pumping Station system. 3. Northeast into Stallingborough North Beck. The watercourse is an Environment Agency main river, an Environment Permit (from the Environment Agency) will be required for any	The land in the West Site is being raised from a lowest level of 1.5mAOD to a consistent level of 2.5mAOD. The drainage is planned to capture all flow from the site and limit to a greenfield runoff rate, not just the impermeable parts of the site. By doing this the 1% AEP 1 in 100) event is held on site and the flood risk to surrounding areas is mitigated. The Environment Agency Flood Map for Planning shows the Site is located in Flood Zone 3a (tidal) when the tidal flood defences are not accounted for. The Site benefits from the presence of flood defences up to and including the 0.5% AEP flood event, therefore the actual risk of flooding to the Site from tidal sources is low. However, there remains a residual risk of flooding should there be overtopping or a breach in the flood defences. This is considered further in the **FRA [TR030008/APP/6.4]** and in **Section 18.8** of this chapter. Compensatory storage is not required to mitigate for residual *tidal* flood risks, (but might have been required if the Project had been located within the *fluvial* Flood Zone 3 extent). The areas of the Site that contain the Project currently drain to the identified systems 2 and 3 and this would be maintained by the proposed works. Discharge rates have been agreed with the IDB and are described in the Drainage Strategy report **(Appendix 18.B [TR030008/APP/6.4]**). No work would be undertaken within the stated distance of a board maintained watercourse. The works will impact board maintained watercourses by changing flow rates. The IDB have stated that Drainage Consent will be required. The Applicant is in discussion with the North East Lindsey Drainage Board about disapplication of the land drainage consent within the DCO. See Article 3 of the **draft DCO [TR0300008/APP/2.1]**.

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		works within Byelaw distance and discharge outfall(s). Any surface water discharges into the drainage systems to be attenuated to an agreed rate. As a brown field site the surface water discharge into the Boards drainage systems from any re-development will be expected to be reduced to 70% of the existing 'actual' discharge rate via any discharge points or routes. It is essential a full survey is undertaken to establish the existing surface water drainage system, catchments and current discharge rates. The Board has been contacted directly by the Consultants undertaking the drainage design for the site. Under the terms of the Board's Byelaws, the prior written consent of the Board is required for any proposed temporary or permanent works or structures in, under, over or within the byelaw 9m distance of the top of the bank of a Board maintained watercourse, Habrough Marsh Drain (8). Under the terms of the Land Drainage Act. 1991 the prior written consent of the Board is required for any proposed temporary or permanent works or structures within any ordinary watercourse including infilling or a diversion. An area of concern is the impact offshore. The proposals show new infrastructure in the Humber near to the gravity outfall of Habrough Marsh Drain, there is concern that this will result in siltation which will impede the discharge. The	The Habrough Marsh Drain gravity outfall and the associated intertidal area is considered in **Chapter 16: Physical Processes [TR030008/APP/6.2].** The Chapter assesses the impacts of the marine development for both the construction and operation phases of the Project. **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*." Based on this assessment no likely impacts are predicted from the construction and operation of the offshore infrastructure on the function of drains, outfalls etc, therefore any impacts on flood risk onshore are considered unlikely.* The proposed works do not cause any impact to the access of IDB land.

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		Flood Risk Assessment should address this and put in place measures to mitigate it. With regard to the land owned by the North East Lindsey Drainage Board a land interest questionnaire was returned on 16th November 2016. The land is adjacent to Parcel 55 which is the A1173. If the access to the Board's land is affected it is essential the Board is contacted to discuss and agree future access arrangements.	
		Change 2: Marine Design Changes Table 7.2 of the PEIR Addendum for Water Quality, Coastal Protection Flood Risk and Drainage states that "The changes in jetty alignment, length, the berth arrangements, and dredging requirements have the potential to increase erosion/deposition rates on the foreshore, tidal water levels and wave heights/velocities which in turn can impact existing features, including existing marine infrastructure, outfalls, estuary banks and channels, and the flood defences". We would welcome further detail on the potential changes to physical processes and impacts and how this affects the Stallingborough North Beck outfall, the foreshore and the standard of protection of flood defences on and off site and any mitigation for this that will be proposed.	**Chapter 16: Physical Processes [TR030008/APP/6.2]** assesses the impacts of the marine development for both the construction and operation phases of the Project. **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*." Based on this assessment no likely impacts are predicted from the construction and operation of the offshore infrastructure on the function of drains, outfalls etc, therefore any impacts on flood risk onshore are considered unlikely.
19.06.2023	Environment Agency	Change 7: Public Rights of Way Diversion and removal of other informal access points	Infrastructure to enable the Environment Agency ongoing access to the sea wall for flood defence monitoring and maintenance activities will be provided. This currently comprises a ramp off the Jetty Access Road.

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		Environment Agency access to the defence of the North site of the jetty must be maintained. We are engaged with Associated British Ports (ABP) and welcome continued pre-application discussions in respect of the works close to and over the existing defences and main rivers. The diversion takes the bridleway close to the flood defence assets on Stallingborough North Beck. Appropriate mitigation measures should be put in place to ensure that no access can be gained to the flood defences. We would require a 1m buffer from the landward toe to enable maintenance to be carried out on the flood defences. Sufficient details should be provided to detail these mitigation measures. Table 7.2 of the PEIR Addendum for Water Quality, Coastal Protection Flood Risk and Drainage explains that the temporary ProW diversion may mean that a temporary bridge could be needed over the channel behind the sea wall. We would welcome discussions about this structure as part of our continuing engagement with ABP.	Correspondence from the Environment Agency has confirmed that the requirement of a 1 m buffer for maintenance purposes is no longer required.
		Given the location of the project and the relationship of the proposal with our network, we do not believe that the proposals as shown would impact our interests. Our closest waterways are the River Trent, River Ouse and the Aire & Calder Canal, all of which are located over 40km inland from the proposal. The Trust is Navigation	Noted: The Project is not located in close proximity to any Canal and River Trust Assets. A consultation response was requested from Louth Navigation Trust, however a response has not been received.

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		Authority for these waterways. Should the scheme be amended to potentially affect our navigations, we would welcome further consultation on the proposals, so that we can advise about any potential impact for our network. The Louth Canal is not owned or managed by the Trust. However, pursuant to the charitable objectives of the Trust, the Trust supports the preservation, conservation and protection of inland waterways for the public benefit. We are aware that the Louth Navigation Trust (LNT) is dedicated to preserving the canal and encouraging future regeneration of the Louth Canal and support such initiatives. We recommend that you correspond with the LNT regarding your proposal, and we advise that consideration is given to any response from LNT on any impact that the proposal might have on preservation and regeneration objectives.	
	Canal and River Trust	We note that the efficient use of water and utility connections are part of one of the five objectives for the project. Please find attached Anglian Water's new Non-Domestic Water Demand Position. Without the agreement by regulators to the inclusion of the 60MLD in the draft WRMP, the provision of water for the project would have had to be outside the AWS regulated business. This may still be the case if regulators decline to support the AWS proposal for a desalination plant or final effluent reuse.	As stated above, the commercial offer received from Anglian Water over the supply of resources, means that no further assessment is required of any impacts associated with water demand or supply, including any environmental impacts which might be associated of the provision of resources including any new abstractions. Anglian Water as part of their Water Resources Management Planning (WRMP24) process would have made their own assessment in order to give this response. The offer now received from Anglian Water (dated 27 July 2023) for a non-potable supply is sufficient for the Project Phases 1 to 6 (see **Paragraph 18.7.618.7.6**).

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		Please note that the position requires that applicants, including NSIP projects will be required to work with us to produce a Water Resources Assessment as part of the EIA for the project and this will be submitted with the DCO, updated through the Examination – partly in response to the WRMP progression – and will then require finalisation and agreement by the local planning authority as DCO Requirement Approval Body in consultation with the EA and other bodies including AWS.	
	Anglian Water	The changes to the project (summarised as A to F on the map) do not materially change the project for AWS or raise new issues for AWS. We support the changes to the project red line area which enable the retention of woodland. We also support the changes in landform which assist in the natural drainage of the site.	Noted
		5.16 We concur that one of the most important questions raised by the first Statutory Consultation is the water demand requirements	Noted
		6.5.2 We note the ground raising proposed for the west site and support in principle the change to a project to ensure surface drainage can be achieved without adding to water going to public sewers or causing increased flood risk at lower elevations. We would welcome confirmation that the planned drainage and run off rates or other changes proposed have been assessed and do	The Drainage Strategy (**Appendix 18.B [TR030008/APP/6.4)** includes provision of attenuation storage for surface water over the lifetime of the development and retains surface water on the West Site up to the 1% AEP plus 40% climate change event. Discharge rates from the West Site are restricted to the greenfield runoff rate and surface water is discharged to the Immingham Pump Drain via a local land drain to the south of the Site, providing betterment over the current scenario. Drainage and runoff should

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		not pose a hydrological risk to AWS underground assets. This assessment should be included in the Water Quality, Coastal Protection, Flood Risk and Drainage EIA Chapter.	therefore not pose a hydrological risk to AW underground assets. Paragraph 18.7.35 states no impact to existing underground assets.
		Table 7.2, page 32 and 33. We note the conclusion that the changed landform will assist in managing stormwater and that there are no new or different significant effects. Please include the assessment of the impact on AWS assets in the Water Quality, Coastal Protection, Flood Risk and Drainage EIA Chapter.	The assessment on AWS assets has been included in **Section 18.7**, where applicable.
		General comment. Whilst the consultation is to seek views on the eight changes, we would have expected the PEIR Addendum to set out how the EIA will look to address the 'water demand requirements' identified in the first statutory consultation. We would welcome detailed further engagement on the Water Resources Assessment (WRA) at the earliest opportunity and potentially in liaison with the EA to ensure that the WRA methodology is agreed and takes into account and assesses impacts and receptors in the event of a reasonable worst-case scenario as required by EIA regulations. We have advised the Planning Inspectorate on the water resources issue across the Anglian Water region and the requirement now for non- domestic water demand and its supply to be considered by applicants, including NSIPs, when that new demand exceeds 50,000 litres per day	Arising from discussions with Anglian Water a commercial offer has been made to provide a sub-potable supply of water from a non-potable water main within Laporte Road. This water will originate from an existing Anglian water source with capacity and will be transferred to the site for use via a non-potable water main.

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		We note that water is referred to once in the summary of project objectives. We welcome the reference to the role of the EA (para 1.30) and would have anticipated that the projects work with AWS would have been referenced in this section. In developing our non-domestic demand position statement, it is evident that one of the primary concerns of local councils and communities is whether a new major water demand project could jeopardise supplies to homes and existing businesses. Whilst it is our regulatory duty to ensure there is a supply demand balance for current and future planned domestic needs, we would ask the IGET project to ensure that it emphasises in its communications to the community that water supplies to homes and businesses will not be interrupted or reduced as a result of the project. We recommend given the IGET projects promoters that this message of no impact on domestic supplies is included in the cumulative impact assessment for the IGET project and provided to communities and local business stakeholders.	Public water supply in the homes and businesses located within the local community will not be affected by the development being undertaken. The water supply agreement with Anglian Water will not impact on the availability of water within the local area and network infrastructure will not be impacted by construction at the Project Site.
		Section 1.3: Data Sources Throughout the document reference is made to 2011 North East Lincolnshire Strategy Flood Risk Assessment (SFRA); these references should be revised to reflect	Noted. This has been updated throughout the FRA, at **Appendix 18.A [TR030008/APP/6.4]**

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August 2023	Environment Agency (Review of Draft FRA)	**Section 2.7: Hydroplogy and Flood Risk Management Infrastructure** *Surface Watercourses:* paragraph 2.7.1, 2nd bullet point – the Main River that lies to the east and sourth of the site boundary flowing from east to west is the Stallingborough North Beck	Section 2.7 of the FRA, at **Appendix 18.A [TR030008/APP/6.4],** has been updated to state "Environment Agency Main River: Stallingborough North Beck Drain (referred to as 'North Beck Drain' throughout the FRA) lies to the east and south of the Site Boundary flowing from east to west".
		We require an 8m clear strip from the landward toe of the fluvial defence to allow for maintenance and access. Any compound or storage would need to be further than 8m from the landward toe.	Section 10.1 of the FRA, at **Appendix 18.A [TR030008/APP/6.4],** has been added to reflect this requirement.
		There is a small area of Work N. 9 which is covered by the 0.1% defended and undefended fluvial extents from the Stallingborough North Beck. We request that nothing is located within this area of the fluvial floodplain to allow storage in case of high flows on Stallingborough North Beck. Maps may have been provided to show this area but if these are required, please let us know and we will provide them.	Section 4.4 of the FRA, at **Appendix 18.A [TR030008/APP/6.4],** has been updated to reflect this information. The additional mapping has been requested for reference from the Environment Agency.
		Section 3.2: Development and Flood Vulnerability Paragraph 3.2.21 – we support the intention to shut down the facility during periods when there is a flood warning in place. We also welcome the confirmation that the site can shut down in situ or remotely.	Noted.
		Section 3.4: North East Lincolnshire Strategic Flood Risk Assessment	Paragraph 3.4.11 5th Bullet Point in the FRA, at **Appendix 18.A [TR030008/APP/6.4]**, has been amended to reflect the need for an

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		Paragraph 3.4.11, 5th bullet point – we do not normally comment on or approve the adequacy of flood emergency response procedures accompanying document proposals, as we do not carry out these roles during a flood. Our involvement with this development during an emergency will be limited to delivering flood warnings to occupants/users covered by our flood warning network. This paragraph should be updated to reflect that an appropriate flood warnng and evacuation plan will need to be submitted to approved by North East Lincolnshire Council.	appropriate flood warning and evacuation plan will need to be submitted to approved by NELC.
		Section 4.4: Fluvial Sources Paragraph 4.4.8 - an assessment of the residual risk of a breach in the fluvial defences should be made in this FRA, particularly in relation to the temporary construction area (Work No. 9). It has been noted that the modelled flood levels for the Stallingborough North Beck in Table 4-5 show the wrong levels for the 1 in 1000 (0.1%) AEP. This appears to be an error in the model outputs that has since been rectified. A new table with updated levels can be found below, which will allow a more accurate assessment of the residual risk from a breach of the fluvial defences to be made.	Table 4.5 in the FRA at **Appendix 18.A [TR030008/APP/6.4]**, has been updated to present the correct 0.1% AEP flood water levels provided by the Environment Agency. The assessment of residual risk from a breach in the fluvial flood defences is provided in Section 4.4 of the FRA at **Appendix 18.A [TR030008/APP/6.4]**,
		Section 5: Impacts of the Development on Flood Risk	Paragraph 5.2.5 in the FRA **[TR030008/APP/6.4]** has been amended to reflect the assessment undertaken in **Chapter 16: Physical Processes [TR030008/APP/6.2]** states "*Across the wider study area (including the existing berths at Immingham Oil Terminal (IOT), the rest of the intertidal*

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		Paragraph 5.2.5 states that there will be a '*small*' impact on "*the adjacent foreshore areas fronting the Project site, which include a number of outfalls, including the Habrough Marsh Drain*". However, previous paragraphs indicate that Chapter 16: Physical Processes [TR030008/APP/6.2] concludes that there will be no likely impact on existing accretion rates. Could this be clarified, please? Any increase in sedimentation to the Stallingborough North Beck Outfall and the Habrough Marsh Drain Outfall would require mitigation to ensure flow is not affected.	*area along the Immingham frontage, the Habrough Marsh Drain and Immingham Sea outfalls, the offshore banks and channels and the wider estuary up- and down-stream), the Project marine facilities have no impact on the existing (baseline) accretion and erosion rates*."
		Section 5: Impacts of the Development on Flood Risk Paragraphs 5.3.2 and 5.3.3 appear to contradict each other – could you please correct them as appropriate?	Paragraphs 5.3.2 and 5.3.3 in the **FRA**, **Appendix 18.A [TR030008/APP/6.4]**, have been amended for clarity.
		Section 5: Impacts of the Development on Flood Risk Paragraph 5.3.4 – we note that reference was made in the Preliminary Environmental Information Report (PEIR) addendum for land raising to the West Site but not the East Site. We require a full assessment of land raising and the potential impacts to third parties from tidal sources. This could entail rerunning the individual hazard mapping breach to show where the displaced flood water would go and the impacts of this.	The FRA and the summary provided below at **Section 18.11** of this chapter concludes that given the presence of the tidal flood defences, which would be raised by the Environment Agency in line with flood management plan proposals in order to maintain the standard of protection along the Humber Estuary in this area, the Project is considered to be at low risk of tidal flooding. It is unlikely, given the extent and depth of flooding along the South Humber Bank should a breach occur, that the Project would increase the risk of flooding off-site to surrounding land over its lifetime as these areas would be flooded to the same depth as the Site. Any increase in flood water level is likely to be insignificant.

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		In the current overall site layout, the West Site is not within an area at risk from fluvial flooding from the Main Rivers. However, the site may be at risk from local ordinary watercourses for which other risk management authorities, such as the Lead Local Flood Authority or Internal Drainage Board have responsibility. The FRA should assess the impacts of land raising on the displacement of flood water from non-Main River sources and whether any floodplain compensatory storage is required. The FRA has currently only assessed the floodplain compensation from Main River flooding.	Mapping of fluvial flood extents (as provided in the NELC PFRA (Ref 18-16) shows the Project is located in Flood Zone 1 (low risk) and analysis of the Environment Agency RoFSW mapping (Figure 18.3) shows only small areas of surface water flooding from low to high risk associated with topographical low spots and constrained to watercourse corridors. Given the location of the Project in an area of low fluvial risk (Flood Zone 1) there would be no loss of floodplain storage and no negative impact on third parties.
		Section 6: Mitigation of Future and Residual Flood Risks and Off-Site Impacts Paragraph 6.3.1 - we support the inclusion of the flood resilience and resistance mitigation measures included in this paragraph.	Noted
		Section 6: Mitigation of Future and Residual Flood Risks and Off-Site Impacts Paragraph 6.6.2 - we also support the use of an area of safe refuge. However, it is worth noting that the flood refuge platform would only serve as an area of safe refuge for the control room building itself and its immediate vicinity. The occupants of the rest of the site could have to walk through deep flood water to reach the control room building, which could pose a risk to life. Adding additional areas of safe refuge across the site would provide more options for staff if safe evacuation couldn't be achieved.	Noted. Areas of safe refuge are included at the control room building and Toxic Safe Haven building on the West Site and at the control room building on the East Site.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Section 6: Mitigation of Future and Residual Flood Risks and Off-Site Impacts Paragraph 6.9.3 - this suggests that the existing flood wall will be extended so the existing wall will remain in place. We are of the understanding that the wall will be replaced as it could be difficult to raise the existing wall. Therefore, a secondary containment may be required for the duration of the wall replacement.	The relevant sections of the FRA, at **Appendix 18.A [TR030008/APP/6.4]**, have been updated to reflect the replacement of the section of flood defence wall underneath and in proximity to the jetty access road/pipe-rack as it crosses the flood defence. It is noted that these works may require a secondary containment for the duration of the wall replacement (Section 6.9 of the FRA, at **Appendix 18.A [TR030008/APP/6.4]**. The contractor will be required to provide a deployable or temporary flood defence works method, approved by the Environment Agency, prior to the commencement of the works, or through structuring the works in such a way that the existing defence wall can remain in-situ until the new structure is completed (Section 6.9 of the FRA, at **Appendix 18.A [TR030008/APP/6.4]**,
		Section 6: Mitigation of Future and Residual Flood Risks and Off-Site Impacts Paragraph 6.9.5 - the most recent drawings seen by the Environment Agency show a pile through the slope of the embankment. This should be updated in the FRA with the mitigation that the embankment will be monitored and if there is any structural movement or damage to the embankment the damage will be rectified, and we must be notified.	Paragraph 6.9.4 & 6.9.5 of the FRA, at **Appendix 18.A [TR030008/APP/6.4]**, have been amended to reflect the current location of the piling in relation to the embankment and the monitoring/survey required by the Environment Agency has been outlined.

Reference/ Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Section 6: Mitigation of Future and Residual Flood Risks and Off-Site Impacts Paragraph 6.9.6 - we would like to see a contingency plan for the construction of the new flood wall as part of the Development Consent Order submission. There should be a form of continuity of defence at all times to ensure that flood risk is managed throughout.	Text in Section 6.9 of the FRA, **Appendix 18.A [TR030008/APP/6.4]**, has been amended to state "On the landward side, temporary works and contingency measures will be put in place, as necessary, for the construction of the proposed the ramps and new section of flood defence to ensure the continuity of the flood defence throughout the works. The contractor will be required to provide a contingency plan for deployable or temporary flood defence works methods, approved by the Environment Agency, prior to the commencement of the works, or through structuring the works in such a way that the existing defence wall can remain in-situ until the new structure is completed"

18.3 Legislation, Policy and Guidance

18.3.1 **Table 18-2** presents the legislation, policy and guidance relevant to the water quality, coastal protection, flood risk and drainage assessment and details how their requirements would be met by the Project.

Table 18-2: Relevant legislation, policy and guidance regarding Water Quality, Coastal Protection, Flood Risk and Drainage

Legislation/Policy/Guidance	Consideration within the ES
The Water Act 2014 (Ref 18-1)	
The aim of the Act was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods. The Act describes provisions for the following: abstraction water license modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.	Abstractions located within 1km radius of the Site Boundary are described in **Chapter 21: Ground Conditions and Land Contamination [TR030008/APP/6.2]**.
The Floods and Water Management Act 2010 (Ref 18-2)	
The aim of the Act was to make provision about water, including provision about the management of risks in connection with flooding and coastal erosion.	Flood risks associated with Project are assessed in the FRA (**Appendix 18.A [TR030008/APP/6.4]**) and summarised in **Section 18.8** of this chapter.
The Land Drainage Act 1991 (as amended) (Ref 18-3)	
The aim of the Act was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods. The Act describes provisions for the following: abstraction water license modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.	Abstractions located within a 1km radius of Site Boundary are described in **Chapter 21: Ground Conditions and Land Contamination [TR030008/APP/6.2]**. Flood risks associated with Project are assessed in the FRA (**Appendix 18.A [TR030008/APP/6.4]**) submitted with the DCO application.
The Water Resources Act 1991 (Ref 18-4)	
Previously under the Water Resources Act 1991 and now under the *Environmental Permitting (England and Wales) Regulations 2016 (as amended)* it is an offence for a person to cause or knowingly permit pollution of controlled waters The Act provides a framework for the application of environmental permits as well as receiving, varying, transferring and surrendering permits and compliance/enforcement of permits.	Controlled waters are discussed in **Section 18.4**. Potential impacts upon controlled waters are discussed in **Sections 18.8**.

Legislation/Policy/Guidance	Consideration within the ES
The Salmon and Freshwater Fisheries Act 1975 as amended (Ref 18-5)	
The aim of the Act is to protect salmon and trout from commercial poaching, to protect migration routes, to prevent willful vandalism and neglect of fisheries, ensure correct licensing and water authority approval.	The mitigation measures are detailed in **Section 18.7** and aim to protect salmon and freshwater fisheries within the Humber Estuary.
The Environmental Permitting (England and Wales) Regulations 2016 (Ref 18-6)	
The Regulations set out the measures for those carrying out activities that may cause imminent threats of, or actual 'environmental damage', which require a permit. These Regulations also outline the authorities responsible for enforcing the Regulations. Such Regulations cover environmental permits, discharge into regulated facilities, enforcement and offences, public registers and powers/functions of the regulator and authority.	**Section 18.7** provides details of mitigation measures that aim to prevent environmental damage.
The Environmental Damage (Prevention and Remediation) Regulations 2015 (Ref 18-7)	
The Regulations concern the prevention and remediation of environmental damage to: (a) protected species or natural habitats, or a site of special scientific interest, (b) surface water or groundwater, or (c) land, as specified in Regulation 4. They implement Directive 2004/35/EC of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage.	Protected habitats and water bodies are discussed in **Section 18.6**. Potential impacts are discussed in **Sections 18.8** and **18.10**, whilst mitigation measures are detailed in **Section 18.7**.
The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 & 2017; incorporated in **The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.** (Ref 18-8)	
The principal objective of the framework is for all groundwater, surface water and coastal water bodies to achieve 'good' status by 2015 and maintain this status. It includes broader ecological objectives as well as aims to prevent deterioration of all water bodies. The framework aims to develop sustainable water use and reduce and eliminate the presence of hazardous substances within water bodies. It must be considered in any scheme that has the potential to have an impact on any part of the water environment.	Water Framework Directive (WFD) surface water and groundwater bodies are described in **Section 18.6** and **Table 18-6**. Potential impacts to WFD surface water bodies are outlined in **Section 18.8**. A **Water Framework Directive Compliance Assessment** is appended at **Appendix 17.A[TR030008/APP/6.4]**

Legislation/Policy/Guidance	Consideration within the ES
The Groundwater (England and Wales) Regulations 2009 (Ref 18-9)	
The Regulations relate to the pollution of groundwater and provide rules for the granting by the Environment Agency of a permit under these Regulations, consent under section 91(8) of the Water Resources Act 1991 and (with exceptions) an environmental permit under the Environmental Permitting (England and Wales) Regulations. In addition, the Regulations create an offence of discharge of a hazardous substance or non-hazardous pollutant without a permit, provide for powers of enforcement of the Environment Agency and prescribe penalties for offences committed under these Regulations.	Potential impacts associated with the discharge of a hazardous substances or non-hazardous substances are considered in **Section 18.8**.
The Control of Pollution (Oil Storage) (England) Regulations 2001 (Ref 18-10)	
The Regulations require a person having custody or control of oil to carry out certain works and take certain precautions and other steps for preventing pollution of any waters which are controlled waters for the purposes of Part III of the Water Resources Act 1991. Regulation 2(2) sets out circumstances in which these Regulations do not apply to the storage of oil. Regulation 3 imposes general requirements in relation to the storage of oil. Additional requirements which apply to specific types of container are imposed by regulation 4 and regulation 5. Regulation 6 contains transitional provisions. Where in a transitional case the Environment Agency considers that there is a significant risk of pollution of controlled waters from the oil in question it has the power to serve a notice on the person having custody or control to minimise the risk (see reg.7).	Controlled waters are discussed in **Section 18.4**, whilst potential risks to controlled waters are discussed in **Section 18.8**.
National Policy Statement for Ports (NPSfP) (Ref 18-11)	
The NPSfP is a framework to address proposals for port development in the UK and associated development (rail and road). It describes the UK Government's policy on new port infrastructure in the context of future demand, needs and the current economy. The Project is considered to be a Nationally Significant Infrastructure Project (NSIP) within the ports industry.	NPSfP requirements are used in assessing the impact of the Project on the water environment – refer to **Section 18.8**. The FRA (**Appendix 18.A [TR030008/APP/6.4]**) assesses flood risk in line with applicable policy requirements.
The aims of the NPSfP for development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such	The FRA (**Appendix 18.A [TR030008/APP/6.4]**) identifies and assesses flood risk from all sources (tidal, fluvial, surface water, groundwater, drainage infrastructure and artificial sources) and outlines mitigation measures to keep the Project safe should a flood event occur. The accompanying **Planning**

Legislation/Policy/Guidance	Consideration within the ES
areas, including 'water compatible' development, the policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall. Port development is defined as being water compatible development and, therefore, acceptable in high flood risk areas (Paragraph 5.2.3). The NPSfP state*s "all applications for port development of 1 hectare or greater in Flood Zone 1 and all proposals for projects located in Flood Zones 2 and 3 should be accompanied by a flood risk assessment (FRA). This should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account*" (Paragraph 5.2.4). The NPSfP notes that the latest set of UK Climate Projections should be used in assessments to ensure the appropriate adaptation measures have been identified. "A*pplicants should apply, as a minimum, the emissions scenario that the independent Committee on Climate Change suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections such as Environment Agency Flood Maps*" (Paragraph 4.13.7). Paragraph 5.2.18 of the NPSfP states "T*he Government's view is that there is no 'public good' need, on national resilience grounds, to require a higher specification than will secure commercial resilience of the individual facility, notwithstanding that some types of severe weather may effect ports in a region or along a particular stretch of coastline, for example from a storm surge. The NPSfP provides more generally for resilience and diversity of ports provision. Applicants will be in the best position to make a commercial judgement on the required appropriate adaptation measures to reduce the risk from long term climate change as it affects their own facilities*". Section 5.6 of NPSfP states that "*Infrastructure development can have adverse effects on the water environment, including groundwater, inland surface water, transitional waters and coastal waters. During the construction, operation and decommissioning phases, it can lead to increased demand for water, involve discharges to water and cause adverse ecological effects resulting from physical modifications to the water environment.*" The consideration of these effects in terms of water	**Statement [TR030008/APP/7.1]** provides information with regards site allocations and **Chapter 3: Need and Alternatives [TR030008/APP/6.2]** outlines the site selection study to support the sequential test. The FRA (**Appendix 18.A [TR030008/APP/6.4]**) identifies and assesses flood risk from all sources (tidal, fluvial, surface water, groundwater, drainage infrastructure and artificial sources) and outlines mitigation measures to keep the Project safe should a flood event occur. Climate change for the lifetime of the Project has been assessed in line with the Environment Agency Guidance (Ref 18-34). **Section 18.7** and the FRA (**Appendix 18.A [TR030008/APP/6.4]**) outline the flood risk mitigation measures for the Project including flood resilience and resistance measures, site operation and shut down, flood emergency response plans and elevation of critical plant equipment. A **Water Framework Directive Compliance Assessment** is appended at Appendix **17.A [TR030008/APP/6.4]** and potential impacts to WFD surface water bodies are outlined in **Section 18.8**.

Legislation/Policy/Guidance	Consideration within the ES
bodies failing to meet environmental objectives established under WFD legislation will be necessary.	
National Planning Policy Framework ("NPPF") (Ref 18-12)	
The NPPF sets out the government's planning policies and how these are expected to be applied. The NPPF states that "*when determining planning applications, LPA's should ensure that flood risk is not increased elsewhere (…) where appropriate, applications should be supported by a site-specific Flood Risk Assessment*".	The impact assessment of the Project on the water environment has been undertaken in accordance with the guidance provided in the NPPF, i.e. to ensure that flood risk is not increased elsewhere. This is demonstrated in this ES chapter and in the supporting FRA (**Appendix 18.A [TR030008/APP/6.4]**).
National Planning Practice Guidance ("NPPG") (Ref 18-13)	
The NPPG provides guidance for local planning authorities on assessing the significance of water environment effects of proposed developments. The guidance highlights that adequate water and wastewater infrastructure is needed to support sustainable development.	This guidance has been considered within **Section 18.8** when establishing the potential effects of the Project on the local aquatic environment and ensuring the sustainability of the development.
Flood Risk and Coastal Change NPPG (Ref 18-14)	
The Flood Risk and Coastal Change NPPG recommends that "*Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to public and property and manage any residual risk, taking account of the impacts of climate change, by:* • *Applying the Sequential Test;* • *Applying the Exception Test if necessary;* • *Safeguarding land from development that is required for current and future flood management;* • *Using opportunities offered by new development to reduce the causes and impacts of flooding; and* • *Where climate change is expected to increase flood risk, seeking opportunities to facilitate the relocation of the development*".	The NPPG provides general guidance on flood risks in the context of developing local plans. The FRA for the Project (**Appendix 18.A [TR030008/APP/6.4]**) is aligned with the direction provided by the NPPG in relation to the location of development. The accompanying **Planning Statement [TR030008/APP/7.1]** provides information with regards site allocations and ES **Chapter 3: Need and Alternatives [TR030008/APP/6.2]** outlines the site selection study to support the sequential test.
Government's Green Future: 25 Year Plan to Improve the Environment (Ref 18-15)	
Sets out the Government's goals for improving the environment within a generation and leaving it in a better state than we found it. With regards to the water environment, the Plan includes specific goals to reduce the environmental impact of water abstraction, meet the objectives of River Basin Management Plans under the WFD, reduce leakage	The green future plans were used in **Section 18.8** for assessing the impact of the development on the Estuary bordering the Site by factoring in climate change in future baseline scenarios.

Legislation/Policy/Guidance	Consideration within the ES
from water mains, improve the quality of bathing waters, restore protected freshwater site to a favourable condition, and do more to protect communities and businesses from the impact of flooding, coastal erosion and drought.	
Government's Water Strategy for England, Future Water (Ref 18-16)	
Sets out the Government's goals for improving the aquatic environment within a generation ensuring that water quality remains high, with resources being maintained and future drought scenarios being mitigated with the environment also being protected from climate change events.	The Strategy has been used during the completion of **Section 18.6** where baseline conditions and future impacts from contamination risks are explored.
Non-statutory Technical Standards for Sustainable Drainage Systems ("SuDS") (Ref 18-17)	
Sets out the Government's long-term vision for water and the framework for water management in England. It aims to permit the supply of secured water supplies whilst ensuring an improved and protected water environment. Planning policy encourages developers to include SuDS in their proposals where practicable. Defra have provided guidance on the use, design and construction of SuDS in Non-Statutory Technical Standards. A review of Schedule 3 of the Flood and Water Management Act 2010 was published by the UK Government in January 2023 and recommended implementation of Schedule 3 in England. Schedule 3 requires developers to seek approval from a Sustainable Drainage Approving Board (SAB), who must determine whether the application meets the National Standards. Defra is currently carrying out further work to draft these standards which each SAB will refer to, and these are expected to be published in 2024.	The technical standards are used to assess the SuDS requirements within the **Drainage Strategy** at **Appendix 18.B [TR030008/APP/6.4]**
North East Lincolnshire Council (NELC) Local Plan (Ref 18-40)	
The following policies of the NELC Local Plan are relevant to the water quality, coastal protection, flood risk and drainage assessment: Policy 33: Flood Risk. This policy outlines the requirements of the Sequential and Exception Tests and sets out criteria that development proposals should demonstrate in order to minimise flood risk impacts and mitigate against the likely effects of climate change. This criteria includes a undertaking a site-specific flood risk assessment , no unacceptable increased risk of flooding to the development site or existing properties, the development will be safe during its lifetime, SuDS have been incorporated into	The FRA (**Appendix 18,A [TR030008/APP/6.4]**) sets out the policy and provides a summary of the Sequential Test/Exception Test undertaken to support the location of the Project in compliance with this policy. This is supported by **Chapter 3: Need and Alternatives [TR030008/APP/6.2]** and the **Planning Statement [TR030008/APP/7.1]** (submitted as part of the DCO application) which provides details on the site allocation. The FRA fulfils Element 3 of the NPSfP Exception Test requirement – "*an FRA must demonstrate that the project will be safe,*

Legislation/Policy/Guidance	Consideration within the ES
the development unless their use has been deemed inappropriate, opportunities to provide NFM and mitigation through green infrastructure, arrangements for the adoption, maintenance and management of any mitigation measures, access to any watercourse or flood defence asset for maintenance, clearance, repair or replacement is not adversely affected; and the restoration, improvement or provision of additional flood defence infrastructure represents an appropriate response to local flood risk, and does not conflict with other Plan policies. Policy 34: Water Management. This policy outlines the requirements of development proposals in relation to potential impacts to surface and groundwater. Such requirements include sustainable and adequate water supplies on site, efficient water use, adequate foul water treatment and appropriate sewerage systems. The Humber River Basin Management Plan ("RBMP") should be considered. The policy also refers to the importance of protecting groundwater within Source Protection Zones ("SPZ") during construction and operational phases. Policy 40: Developing a green infrastructure network. This policy outlines the importance of green spaces and infrastructure within developments, as well as biodiversity, climate change mitigation and sustainable water management. As part of this policy, open areas between Immingham and the northern industrial development will be given specific protection.	*without increasing flood risk elsewhere and, where possible, will reduce flood risk overall*" The FRA has been undertaken in accordance with the requirements of local policy outlining flood risks to and from the Project and includes mitigation measures where required so the Project remains safe over its lifetime. Flood risk information is provided within **Sections 18.6** and **18.8**. Discussions have taken place with Anglian Water regarding the supply of potable water to the site for the use of cooling. Solutions to providing this water are being investigated that would not introduce further stress into an already pressured water supply zone. These proposed options would see the use of sub-potable sources of water to meet the site's needs. NELC policy has been considered alongside the requirements of the NELIDB to inform the **Drainage Strategy** (**Appendix 18.B [TR030008/APP/6.4]**).
Anglian Water's draft Water Resources Management Plan ("WRMP") December 2022 (Ref 18-19) **Anglian Water's Drought Management Plan ("DMP"), April 2022** (Ref 18-20) **Anglian Water Drought Plan ("DP") 2022 – Strategic Environmental Assessment ("SEA") Environmental Report, April 2022** (Ref 18-20)	The draft WRMP, along with DMP, provides the latest water resources position for the Water Resource Zone in which IGET lies i.e. South Humber Bank. Anglian Water will have done their own assessment of the requested water needs from IGET in determining their ability to supply the project – see **Paragraph 18.4.11**. The DMP and SEA Environmental Report are statutory requirements for water undertakers under the Water Industry Act 1991, as amended in 2003 and 2014. The DP's SEA report is the best available appraisal of environmental effects at periods of extreme drought. No drought schemes are envisaged for South Humber Bank and resources would not be lost for other uses if allocated to meet the operational needs of the project – see **Section 18.6**.

Legislation/Policy/Guidance	Consideration within the ES
Water Resources East – first full draft Regional Water Plan for Eastern England, November 2022 (Ref 18-21) **WRE – Consultation on WRE's draft Regional Plan, July 2023** (Ref 18-22)	The draft Regional WRMP provides a high level picture of water resources across a number of water undertakers in Eastern England. The picture which the consultation neatly summarises is one of east to west transfers, implying that resources in excess of demands are occurring. This point is made in **Paragraph 18.4.11**.

18.4 Assessment Methodology

Assessment Methodology and Scope

18.4.1 There is no standard guidance in place for the assessment of the likely significant effects on the water resources and water environment from developments of this type. Based on professional judgement and experience of other similar schemes which have adopted best practice, a qualitative assessment of the likely significant effects on surface water quality, coastal protection, flood risk and drainage receptors has been undertaken.

18.4.2 The assessment of water resources is an integral part of Anglian Water's WRMP process and trying to replicate for a water resource zone (such as South Humber Bank) would not be possible without commercially sensitive data being shared by the Company[1]. Instead, the position taken is that given the commercial offer made by Anglian Water to Air Products, that in order to give this commitment, then Anglian Water must have already undertaken its own resources modelling and been satisfied that they could supply this even under drought conditions.

18.4.3 The classification and significance of effects has been determined using the principles of the guidance and the criteria set out in DMRB LA 113 (Ref 18-23) adapted to take account of hydromorphology. Although these assessment criteria were developed for road infrastructure projects, this method is suitable for use on any development project and provides a robust and well tested method for predicting the significance of effects. The methodology also considers advice set out in DfT TAG Unit A3, Environmental Impact Appraisal (Ref 18-24).

18.4.4 Following DMRB LA 113 (Ref 18-23), the importance of the receptor and the magnitude of impact is assessed based on **Table 18-3** and **Table 18-4.** The importance of the receptors is determined independently, and these are then used to determine the overall classification and significance of effects set out in **Table 18-5.**

[1] OFWAT's final price determination for Anglian Water is expected in December 2023, at which point some more information may be available on the water resources availability situation.

18.4.5 Whilst other disciplines may consider 'receptor sensitivity', 'receptor importance' is considered here. This is because when considering the water environment, the availability of dilution means that there can be a difference in the sensitivity and importance of a water body. For example, a small drainage ditch of low conservation value and biodiversity with limited other socio-economic attributes, is very sensitive to impacts, whereas an important regional scale watercourse, that may have conservation interest of international and national significance and support a wider range of important socio-economic uses, is less sensitive by virtue of its ability to assimilate discharges and physical effects. Irrespective of importance, all controlled waters in England are protected by law from being polluted.

18.4.6 The approach to defining the importance of water receptors across surface water, hydromorphological and flood risk has been provided in **Table 18-3**.

Table 18-3: Evaluating the Importance for Surface Water, Flood Risk, and Water Resources

Importance	General Criteria	Key Attributes		
		Surface Water	Hydromorphology	Flood Risk
Very high	The receptor has little or no ability to absorb change without fundamentally altering its present character and is of very high environmental value, or of international importance.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 ≥ 1.0m^3/ s; Site protected/ designated under international or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar Site). Critical social or economic uses (e.g. public water supply and navigation).	Unmodified, near to or pristine conditions, with well-developed and diverse geomorphic forms and processes characteristic of river and lake type.	Floodplain or defence protecting more than 100 residential properties from flooding; Flood Zone 3b; Essential Infrastructure or highly vulnerable development; Human receptors – general public, site visitors Very high risk from non-fluvial/non- tidal flood sources; Offsite regional sewerage networks.
High	Receptor of national or regional importance with a low ability to absorb change without fundamentally altering its present character.	Watercourse having a WFD classification as shown in a River Basin Management Plan (RBMP) and Q95 < 1.0m^3/ s; Major Cyprinid Fishery; Species protected under international or UK habitat legislation. Critical social or economic uses (e.g. water supply and navigation). Important social or economic uses such as water supply, navigation or mineral extraction.	Conforms closely to natural, unaltered state and would often exhibit well-developed and diverse geomorphic forms and processes characteristic of river and lake type. Deviates from natural conditions due to direct and/ or indirect channel, floodplain, bank modifications and/ or catchment development pressures.	Floodplain or defence protecting between 10 and 100 residential properties or industrial premises from flooding; Flood Zone 3a; More vulnerable development; Human receptors – construction workers and site operatives with knowledge of site conditions; Low lying land and local pumped drainage network.

Importance	General Criteria	Key Attributes		
		Surface Water	Hydromorphology	Flood Risk
				High risk from non-fluvial/non-tidal flood sources.
Medium	Receptor of regional or local importance, with medium ability to absorb, adapt to or recover from change without significantly altering its present character.	Watercourse detailed in the Digital River Network but not having a WFD classification as shown in a RBMP. May be designated as a local wildlife Site (LWS) and support a small/ limited population of protected species. Limited social or economic uses.	Shows signs of previous alteration and/ or minor flow/ water level regulation but still retains some natural features or may be recovering towards conditions indicative of the higher category.	Floodplain or defence protecting 10 or fewer industrial properties from flooding; Flood Zone 2; Less vulnerable development; Surface water drainage network including drainage ditches. Medium risk from flooding from non-fluvial/non-tidal flood sources.
Low	The receptor is of local importance and tolerant of change without detriment to its character (i.e. has some ability to absorb, adapt to or recover from change).	Surface water sewer, agricultural drainage ditch; non-aquifer WFD Class 'Poor' or undesignated in its own right. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses.	Substantially modified by past land use, previous engineering works or flow/ water level regulation. Likely to possess an artificial cross-section would probably be deficient in bedforms and bankside vegetation. May also be realigned or channelised with hard bank protection, or culverted and enclosed. May be significantly impounded or abstracted for water resources use. Could be impacted by navigation, with associated high degree of flow regulation and bank protection, and probable strategic need for maintenance	Floodplain with limited constraints and low probability of flooding of residential and industrial properties; Flood Zone 1; Water compatible development; Local drainage network (existing private site drainage or soakaway). Low risk from non-fluvial/non-tidal flood sources.

Importance	General Criteria	Key Attributes		
		Surface Water	Hydromorphology	Flood Risk
			dredging. Artificial and minor drains and ditches would fall into this category.	
Negligible	Receptor is resistant to change and is of little or no environmental value.	Not applicable.	Not applicable.	Not applicable.

Note 1: Professional judgement is applied when assigning an importance category to all water features. The WFD status of a watercourse is not an overriding factor and, in many instances, it may be appropriate to upgrade a watercourse which is currently at poor or moderate status to a category of higher importance to reflect its overall value in terms of other attributes and WFD targets for the watercourse. Likewise, a watercourse may be below Good Ecological Status, this does not mean that a poorer quality discharge can be emitted. All controlled waters are protected from pollution under the Environmental Permitting (England and Wales) Regulations 2016 (Ref 18-6) and the Water Resources Act 1991 (as amended) (Ref 18-4), and future WFD targets also need to be considered.

Note 2: Based on the water body 'Reach Conservation Status' presently being adopted for a major infrastructure project (and developed originally by Atkins) and developed from Environment Agency conservation status guidance (Ref 18-25 and Ref 18-26) as LA113 does not provide any criteria for morphology.

18.4.7 The assessment of magnitude of potential change upon water quality, coastal protection, flood risk and drainage receptors take account of the scale of the predicted change to baseline conditions and where there are potential pathways between an impact source/ hazard and identified receptors. This takes into account the spatial scale of the impact, as well as its duration and reversibility (e.g., the impact magnitude may be moderated if the impacts are temporary rather than permanent; or are reversible rather than irreversible).

18.4.8 The magnitude of change on the identified receptors ranges from major adverse to major beneficial. The approach to defining the magnitude of impacts on water receptors is provided in **Table 18-4** below:

Table 18-4: Determining Magnitude of Impact on Water Receptors

Level of Magnitude	Definition of Magnitude and Examples
Major Adverse	Results in a loss of the identified attribute and/ or its quality and integrity. For example, loss of a fishery; decrease in surface water ecological or chemical WFD status or groundwater qualitative or quantitative WFD status. Change in flood risk to receptor from low or medium to high.
Moderate Adverse	Results in impact on integrity of attribute, or loss of part of attribute. For example, partial loss of a fishery; measurable decrease in surface water ecological or chemical quality, or flow; reversible change in the yield or quality of an aquifer; such that existing users are affected, but not changing any WFD status. Change in flood risk to receptor from low to medium.
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability. For example, measurable decrease in surface water ecological or chemical quality, or flow; decrease in yield or quality of aquifer; not affecting existing users or changing any WFD status. Change in flood risk to receptor from no risk to low risk.
Negligible	Results in impact on attribute, but of insufficient magnitude to affect the use or integrity. For example, negligible change discharges to watercourse or changes to an aquifer which lead to no change in the attribute's integrity.
Minor Beneficial	Results in some beneficial impact on attribute or a reduced risk of negative impact occurring. For example, measurable increase in surface water ecological or chemical quality; increase in yield or quality of aquifer not affecting existing users or changing any WFD status. Change in flood risk to receptor from low risk to no risk.
Moderate Beneficial	Results in moderate improvement of attribute quality. For example, measurable increase in surface water quality or in the yield or quality of aquifer benefiting existing users but not changing any WFD status. Change in flood risk to receptor from medium to low.
Major Beneficial	Results in a gain of attribute and/or quality and integrity of the attribute. For example, change in flood risk to receptor from high to medium or low; The improvement of surface water quality or the increase in yield or quality of an aquifer benefiting existing users and a change in the WFD water body status to an improved category.

Level of Magnitude	Definition of Magnitude and Examples
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

18.4.9 The importance of the receptor (**Table 18-3** of this chapter) and the magnitude of change (**Table 18-4** of this chapter) are determined independently from each other and are then used in combination to determine the magnitude of the resultant effect and the overall significance of effects using **Table 18-5** below. Professional judgement has been used to determine the magnitude of the effects where two options are possible in the matrix. Effects which are large or very large are considered to be significant. Effects which are negligible or minor are not significant. Effects which are moderate may be significant or not significant and professional judgement is used to determine which is appropriate in a particular scenario.

Table 18-5: Significance Matrix

Receptor Importance	Magnitude of Impact				
	No Change	Negligible	Minor	Moderate	Major
Very High	Negligible	Minor	Moderate or large	Large or very large	Very large
High	Negligible	Minor	Minor or moderate	Moderate or large	Large or very large
Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or large
Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Negligible	Negligible	Negligible	Negligible or minor	Neutral or minor	Minor

Limitations and Assumptions

18.4.10 The information presented in this assessment is based on the proposed design for the Project and the maximum extents of land required for its construction and operation, in accordance with the application of the Rochdale Envelope approach.

18.4.11 The FRA for the Project is appended as **Appendix 18.A [TR030008/APP/6.4]** and considers the Environment Agency's Coastal Hazard Mapping and the residual risk from coastal flooding. The management of surface water runoff and its disposal from the Site is considered in the **Drainage Strategy** appended at **Appendix 18.B [TR030008/APP/6.4]**.

18.4.12 Water use needs for the Project are defined in **Chapter 2: The Project [TR030008/APP/6.2].** The only requirement for potable supply would be for offices (including fire sprinkler systems), welfare facilities and site safety showers. A non-potable supply is required for operational processes of the hydrogen production facility including for cooling purposes as well as fire water for emergencies. On the basis that a commercial offer is in place with Anglian Water for provision of these resources, no further assessment is required of any impacts associated with water demand or supply, including any environmental impacts which might be associated of the provision of resources including any new abstractions. Anglian Water as part of their Water Resources Management Planning (WRMP24) process would have made their own assessment in order to give this response.

18.5 Study Area

18.5.1 The Site location is shown on **Figure 1.1 [TR030008/APP/6.3],** whilst **Figure 2.3 [TR030008/APP/6.3]** shows the Site plan for the Project, outlining the location of the West Site, Pipeline Corridor, East Site, Temporary Construction Areas (including a concrete batching plant on the East Site (Work No. 5a)) and Jetty sites.

18.5.2 For the purposes of the water quality assessment, a study area of approximately 1km around the Site Boundary (**Figure 18.1 [TR030008/APP/6.3]**) has been considered as this distance is judged to include those surface water bodies that could reasonably be affected (directly or indirectly) by the Project. However, since watercourse flow and water quality impacts may propagate downstream, where relevant, the assessment also considers a wider study area based on professional judgement.

18.5.3 As coastal protection, flood risk and drainage impacts can impact upstream and downstream, this chapter and the FRA (**Appendix 18.A [TR030008/APP/6.4]**) considers a wider study area, where relevant. Professional judgement around hydrological linkages is applied to identify the extent to which such features are considered in the next section.

18.6 Baseline Conditions

Current Baseline

18.6.1 A desk-based study was undertaken in May 2023 to inform the baseline for the Project. The study included analysis of baseline water quality, coastal protection, flood risk and drainage which forms the baseline on which the impact assessment is based. The following data sources were reviewed:

a. Catchment Data Explorer website (Ref 18-27).

b. Multi-Agency Geographic Information for the Countryside (“MAGIC”) website (Ref 18-28).

c. Flamborough Head to Gibraltar Point Shoreline Management Plan (Ref 18-29).

d. Humber Flood Risk Management Strategy (note that this strategy is currently being updated and will be incorporated into the assessment should the update be completed and made publicly available) (Ref 18-35).

e. Environment Agency Flood Maps for Planning (https:// flood-map-for-planning.service.gov.uk) (Ref 18-31).

f. Environment Agency Long-term Information Service Check the long term flood risk for an area in England – GOV.UK (www.gov.uk) (Ref 18-32).

g. Environment Agency Data Request Response (Product 4 and 8) including Coastal Hazard Maps (**Appendix 18.A: Flood Risk Assessment [TR030008/APP/6.4]**).

18.6.2 A Site walkover was undertaken on 15 February 2023 by a surface water quality specialist and hydromorphologist in cold, dry, and fair conditions. The walkover focused on surface waterbodies in the study area, observing their current character and condition, the presence of existing risks and any potential pathways for construction and operational impacts from the Project.

18.6.3 Two rounds of water quality sampling were undertaken on 31 March 2023 and 18 May 2023. These results provided confirmation of condition in the two watercourses nearest to the Site i.e. Habrough Marsh Drain (SW1 & 2) and North Beck Drain (SW3). The results are presented in **Appendix 17.A [TR030008/APP/6.4].**

18.6.4 A WFD assessment has been undertaken to determine the potential implications of the Project on the objectives of the relevant water bodies. This assessment is based on the information and analysis provided within the ES in relation to changes in physical processes, water and sediment quality, and impacts on marine and terrestrial ecological receptors. The WFD assessment can be found in **Appendix 17.A [TR030008/APP/6.4]** and follows the specified methodology outlined in the latest *Clearing the Waters for All* guidance (Ref 18-33). The **Figure 18.4 [TR030008/APP/6.3]** is included to show the WFD Surface Water Bodies within the ZOI.

18.6.5 A FRA has been prepared in accordance with the NPSfP, NPS EN-1 and NPPF due to the size (over 1ha) and location of the Project (in Flood Zone 3). The FRA (presented as **Appendix 18.A [TR030008/APP/6.4]**) assesses the flood risk both to and from the Project and demonstrates how that flood risk would be managed over the Project's lifetime, to satisfy the requirements of the Sequential Test and Exception Test. The FRA has given due regard to climate change in accordance with Environment Agency guidance (Ref 18-34) which has informed the design of the Project (including finished ground and floor levels) as well as the water environment impact assessment reported in this ES.

18.6.6 A Drainage Strategy is provided as **Appendix 18.B [TR030008/APP/6.4]** outlining how surface water runoff would be managed on-site post development. The strategy includes details on surface water attenuation, consideration of climate change and proposed discharge rates to the local land drainage system (the discharge rates have been agreed with the NELIDB.

18.6.7 A qualitative assessment of the water available in the South Humber Bank Water Resources Zone is based on publicly available information contained in Anglian Water's draft WRMP24 (Ref 18-19). The WRMP24 publication indicates that a net surplus of water will be available within the newly formed South Humber Bank water resource zone ("WRZ"). Anglian Water have indicated that approximately 60 Ml/d of water is to be made available for industrial developments within the South Humber Bank WRZ. The WRMP has outlined the future provision for water within the region are suitable for maintaining security of supply from 2025-2050.

Topography

18.6.8 The topography of the Site is low-lying and flat with many areas being as historically reclaimed land. The Site is generally flat and lies between 1.48m Above Ordnance Datum ("AOD") and 3.83m AOD. However, there are high spots between 6.21m AOD and 9.92m AOD in the pipeline corridor section.

18.6.9 At the East Site (**Works No.5**), the ground elevations range from 3.0m – 4.0m AOD. At the East Site (**Works No.3**), ground elevations range from 3.0m - 4.5m AOD. Both sites gradually slope downwards to the south-east, towards an unnamed drainage ditch running to the north-east.

18.6.10 For the West Site (**Works No.7**), the ground elevations range from the highest point of 3.0m AOD at the north-east corner, to 2.0m AOD at the lowest point in the south-west corner. The ground levels slope towards the southern boundary, and a small drainage ditch.

Existing Land Use

18.6.11 The Site is situated to the east of the Port of Immingham, largely outside of the operational area of the Port. The area surrounding the Port is industrial in nature, being dominated by chemical manufacturing, oil processing and power generation facilities. Residential and commercial properties are present to the south of the Port on Queens Road and lie within, and adjacent to, the Site Boundary. Beyond the industrial facilities, the wider area is largely agricultural. The nearest residential area is the town of Immingham approximately 1km from the western edge of the Site.

18.6.12 The Port lies immediately adjacent to the main deep-water shipping channel which serves the Humber Estuary, thereby enabling access to the Port by some of the largest vessels afloat today.

18.6.13 Further information on existing land use, both on Site and in the surrounding area is provided in **Chapter 2: The Project [TR030008/APP/6.2]**.

Surface Watercourses

18.6.14 The following local water features have been identified within or in close proximity to the Site through the inspection of OS 1:10,000 mapping and are presented on **Figure 18.2 [TR030008/APP/6.3].**

18.6.15 The Site is located on the Humber Estuary (River Humber, a tidal watercourse) which originates at Trent Falls, by the confluence of the tidally influenced rivers Ouse and Trent and flows south-east into the North Sea.

18.6.16 Stallingborough North Beck Drain (referred to a North Beck Drain), an Environment Agency Main River lies to the east and south of the Site Boundary. The Drain, an embanked upland river, originates at Little London and receives pumped surface water runoff from south, central and east Immingham as well as land drainage run off from West Lindsey. The North Beck Drain discharges by gravity, via a sluice gate, into the Humber Estuary.

18.6.17 NELIDB are operational within the area and have flood risk management responsibilities over the following Ordinary Watercourses:

a. Habrough Marsh Drain - located to the north and northwest Site Boundary and directly adjacent to the north-northwest boundary of the Pipeline Corridor and East Site. The watercourse drains a significant proportion of Immingham Dock. The watercourse largely skirts the southern and western perimeters of the Port estate and flows from west to east to the north of the Site. The watercourse discharges partly to the Humber Estuary (gravity discharge via sluice gates) and partly to the North Beck Drain via the Immingham Pump Drain and the Immingham Pumping Station, (located approximately 715m south of the West Site, to the west of Kings Road where the road crosses the watercourse).

b. Immingham Pump Drain, located to the west of the Kings Road/A1173, the drain flows from north to south parallel with the road towards the North Beck Drain. The drain receives flows from Haborough Marsh Drain and is pumped into the North Beck Drain via the Immingham Pumping Station.

c. A series of minor land drainage ditches are present within the Site Boundary and in close proximity to the Site Boundary and convey surface water run-off discharges from the Site to the IDB network and the Humber Estuary. These include a drainage ditch along the southern boundary of the West Site (**Work No. 7**), flowing generally from north east to south west, and a drainage ditch along the southern boundary of the East Site (**Work No. 3** and **Work No. 5**), flowing generally from south west to north east. Both drainage ditches ultimately discharge to the North Beck Drain.

Water Quality

18.6.18 The following key water environment receptors have been identified in the vicinity of the Project:

a. The Humber Estuary (Humber Estuary TraC Operational Catchment) and in particular the Lower Humber (GB530402609201) which forms the eastern boundary of the Site Boundary. The review of this waterbody's importance is contained in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**.

b. North Beck, Habrough Marsh drain and local drains (a NELIDB watercourse which skirts the southern and western perimeters of the port estate flowing from south to north) are all located in the vicinity of the Site Boundary (part of Becks Northern Operational Catchment). A summary of WFD data for 2019 for these water bodies is provided in **Table 18-6**.

c. On-shore WFD water bodies: North Beck Drain (GB104029067575) and North Lincolnshire Chalk Unit waterbody (GB40401G401500). The conditions of these waterbodies are Moderate ecological status and Poor overall status, respectively. These classifications by the Environment Agency are based on 'lowest' category, which for the surface waterbody is ecological status and for groundwater is based on resources. A summary of WFD data for 2019 for North Beck Drain and North Lincolnshire Chalk Unit waterbody is provided in **Table 18-6**.

d. Various ecological sites:

   i. Humber Estuary (Ramsar, SPA and SAC). The review of these protected sites is included in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**.

   ii. On-shore limited conservation value apart from small patches of Priority Habitat (Coastal and Floodplain Grazing Marsh and Good quality semi-improved grassland: Non-Priority).

18.6.19 There are a number of large source protection zones ("SPZ") local to the Project, including an SPZ1 (inner zone) lying very close to the edge of the Immingham Docks site. The other SPZs are located west of the coastal strip (presumably designed to minimise saline intrusion). The various abstraction licences associated with these SPZs are described in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**.

18.6.20 Lying further to the west of the coast (west of A180) are various Drinking Water Safeguard Zones (Groundwater) associated with catchments of the SPZs as described above. There are no Drinking Water Safeguard Zones (Surface Waters) in the vicinity of the Site. The Drinking Water Safeguard Zones (Groundwater) are considered in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]**.

18.6.21 The water quality of a non-potable supply, referenced in **18.4.12**, is excluded from baseline as this water is coming from outside the catchment areas of the North Beck, Habrough Marsh Drain and other local drains. Further details of this supply are included in **Section 18.7.**

18.6.22 The WFD Screening Assessment identifies one WFD surface water body (North Beck Drain) as being present within the proposed work area of the Project, as well as a number of unnamed drainage channels. The North Beck Drain WFD water body is indicated to be heavily modified with a moderate ecological status and previous Environment Agency sampling has shown that the water body failed its chemical assessments. Due to the limited data that was available from the water bodies a limited sampling program was implemented to obtain a defined baseline. The **WFD Compliance Assessment** is provided as **Appendix 17.A [TR030008/APP/6.4]**.

Table 18-6: Summary of WFD Data for On-shore Water Bodies (2019)

Classification Item	North Beck Drain (GB104029067575)
Ecological	Moderate
Biological quality elements	N/A
Invertebrates	N/A
Physico-chemical quality elements	N/A
Ammonia (Phys-Chem)	N/A
Hydromorphological supporting elements	Supports good
Supporting elements (surface water)	Moderate
Specific pollutants	High
Chromium (VI)	High
Chemical	Fail
Priority hazardous substances	Fail
Priority substances	Good
Other pollutants	Does not require assessment
Classification Item	**North Lincolnshire Chalk Unit waterbody (GB40401G401500)**
Overall Water Body	Poor
Quantitative	Poor
Quantitative Status element	Poor
Quantitative dependent surface water body status	Poor
Quantitative Groundwater Dependent Terrestrial Ecosystems (GWDTEs) test	Good
Quantitative saline intrusion	Good
Quantitative water balance	Good
Chemical (GW)	Poor
Chemical status element	Poor
Chemical dependent surface water body status	Good

Classification Item	North Beck Drain (GB104029067575)
Chemical drinking water protected area	Poor
Chemical GWDTEs test	Good
Chemical saline intrusion	Good
General chemical test	Poor
Supporting elements (groundwater)	N/A
Prevent and limit objective	Active
Trend assessment	Upward trend

18.6.23 The area surrounding the Site is drained via a network of small land drainage ditches that convey surface water from the surrounding areas located near to the Site to the Humber Estuary.

18.6.24 The smaller land drains and NELIDB drains, whilst shown on the Digital Rivers Network Map, do not have ecological and chemical classification under the WFD.

18.6.25 A detailed description of the water quality results is contained in **Appendix 18.C [TR030008/APP/6.4]**. The locations from which samples were taken is shown in **Figure 18.5**. Specifically in relation to suspended sediments, the results at the two sampling points (defined in **Paragraph 18.6.3** above) are as shown in **Table 18-7**:

Table 18-7: Suspended Sediment Quality (2023)

Location	TSS (mg/l)/Turbidity (NTU) on 31 March 2023	TSS (mg/l)/Turbidity (NTU) on 18May 2023
Un-named drain (U/S from port) (SW2)	28.4 / 25.1 (labs) n/a (field)	89.6 / 73.7 (labs) 116.68 (field)
North Beck Drain (SW3)	9.8 / 8.12 (labs) 18.8 (field turbidity avg)	21.7 / 13.3 (labs) 25.61 (field turbidity avg)

Note: Total Suspended Solids (“TSS”) and turbidity measured in the labs. Also turbidity recorded using a field meter probe

Coastal Protection

Tidal Flood Defences

18.6.26 There are tidal flood defences in place along the entire south bank of the Humber Estuary (**Figure 18.2 [TR030008/APP/6.3]**). Information provided by the Environment Agency shows the tidal flood defences protecting this Site consist of a combination of concrete sheet piled walls and concrete/stone slab revetment walls topped with rock filled gabion baskets and earth embankment topped by a concrete wave return wall comprising a smooth concrete or asphalt seaward

face. The flood defences are in 'good' condition and reduce the risk of flooding currently up to a 0.5% AEP (1 in 200 chance in any year) event, based on Still Tidal Water Levels. The Environment Agency inspects these defences annually to ensure defects are identified.

18.6.27 The Applicant owns and is responsible for the sea walls around its land at Immingham Docks which consist of concrete sheet piled walls and concrete revetment walls topped with rock filled gabion baskets. Information from the Environment Agency shows the flood defences, along the Port of Immingham frontage up to Habrough Marsh Drain, have a crest elevation of 5.05m AOD and a wall height of 0.84 m resulting in a total defence elevation of 5.89m AOD.

18.6.28 To the east of Habrough Marsh Drain, the existing Environment Agency flood defences consist of an earth embankment topped by a concrete wave return wall comprising a smooth concrete or asphalt seaward face.

18.6.29 The flood defences along the wider Humber Estuary south bank frontage are maintained by the Environment Agency. The Environment Agency is responsible for inspecting the condition of all flood defences, including those maintained by Associated British Ports and thus inspections are undertaken annually to ensure confirmed that the condition of the flood defences adjacent to the Site Boundary are classed as 'fair' (Condition Grade 3).

18.6.30 The initial draft Humber Flood Risk Management Strategy (2021 – 2027) (Ref 18-35) advises that improvements to Humber Estuary modelling have been completed as part of the developing Humber 2100+ project, which is redefining the strategic approach to managing tidal risk on the Humber. A further phase of improvements to the tidal defences adjacent to the Port is planned between 2022 - 2024, in continuation of the defence improvements carried out in 2017.

Fluvial Flood Defences

18.6.31 The Environment Agency have confirmed that the existing fluvial defences reducing the risk of flooding from the main river along the North Beck Drain consist of earth embankments. They are in fair condition and reduce the risk of flooding to a 2% (1 in 50) chance of occurring in any year. The Environment Agency inspect these defences routinely to ensure potential defects are identified.

18.6.32 The Environment Agency Asset Management Database identifies that the flood defence embankment levels along the North Beck Drain are between 3.85m – 3.94m AOD along the channel to the south of the Site.

18.6.33 The Habrough Marsh Drain outfall comprises hanging gates and is inspected regularly and maintained by the Environment Agency. The Environment Agency replaced the hanging gates in April 2022. The NELIDB also undertake maintenance work on the Habrough Marsh Drain channel (removal of vegetation and dredging of the channel). The outfall and channel are accessed through the Port of Immingham, via an access road known as East Riverside and sufficient space is currently provided for access.

Flood Risk

Flood Map for Planning

18.6.34 The Environment Agency Flood Map for Planning ("FMfP") available online (accessed May 2023) identifies areas subject to fluvial (main river)/tidal flood risk for the present day but does not include the benefits or impacts of any existing flood defences or climate change respectively.

18.6.35 Mapping shows the terrestrial area of the Project Site is located entirely in Flood Zone 3a (high risk of flooding) – refer to **Figure 18.2 [TR030008/APP/6.3]**. Definitions of Environment Agency flood zones (as defined in Table 1 of the NPPG (Ref 18-14)) are presented in **Table 18-8**.

Table 18-8 Environment Agency Flood Zone Definitions

Flood Zone	Definition	Risk of flooding
Flood Zone 1	Land that has a low probability of flooding (less than 1 in 1,000 annual probability of river or sea flooding (<0.1%))	Low
Flood Zone 2	Land that has a medium probability of flooding (between 1 in 100 and 1 in 1,000 annual probability of river flooding (0.1-1%), or between 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.1-0.5%)	Medium
Flood Zone 3a	Land that has a high probability of flooding (1 in 100 year or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%)	High
Flood Zone 3b (Functional Floodplain)	This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise: • land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).	Very high

Flood Risk from Tidal Sources

18.6.36 Tidal flooding occurs during extreme high tide and/or storm surge events which may cause wave overtopping or the unlikely event of a breaching scenario of existing tidal defences. High water levels within tidally influenced estuaries and rivers may also contribute to tidal flooding.

18.6.37 As defined in **Table 18-8** the terrestrial area of the Site is located in Flood Zone 3a. Although not indicated on the Environment Agency FMfP, the Site is protected from flooding associated with tidal sources up to and including a 0.5 % AEP flood event due to the presence of tidal flood defences along the south bank of the Estuary (see Coastal Protection subsection above). However, areas behind the defences are still considered to be at residual risk of flooding through overtopping or failure of the flood defences, although the likelihood of either occurring is low.

Modelled Tidal Water Levels

18.6.38 The Environment Agency provided modelled tidal peak water levels for the South Humber Bank area. The Environment Agency model demonstrated that during a 0.1% AEP (1 in 1000 chance) event based upon the existing (2017) scenario, tidal levels in the Humber Estuary could rise up to 5.97m AOD at the Habrough gauge and 6.01m AOD at the Immingham gauge.

18.6.39 **Table 18-9** details the modelled tidal water levels provided by the Environment Agency. These are the current best estimate for extreme tide levels in the vicinity of the Site.

Table 18-9: Coastal Flood Boundary Extreme Still Tidal Levels for Immingham and Habrough Marsh

Annual Exceedance Probability	Extreme Still Tidal Levels (m AOD)	
	Immingham (NGR 520440,417625)	Habrough Marsh (NGR 522100,416512)
100%	4.19	4.17
10%	4.62	4.60
2%	5.00	4.97
1%	5.19	5.16
0.5%	5.41	5.38
0.1%	6.01	5.97

18.6.40 Based on the information in **Table 18-9**, the extreme still tidal level for Immingham is 5.41m AOD for a 0.5% (1 in 200 year) AEP event. For Habrough Marsh the extreme still tidal level for a 0.5% (1 in 200 year) AEP event is 5.38m AOD.

Residual Risk – Breach of Defences

18.6.41 The Environment Agency has provided breach location and associated breach flood extent maps from the Northern Area Tidal Mapping Study (presented in Annex 1 of **Appendix 18.A FRA [TR030008/APP/6.4]**). The Northern Area Tidal Mapping Study involved a modelled representation of tidal breaches along the east coast and the south bank of the Humber Estuary, with breaches in the hard defences set at 20m wide with the defences assumed to breach down to the ground level behind the defence. The defences were raised within the model to create reservoir cells, ensuring that the most precautionary volumes of water were driven through the breach opening. The breach location nearest the Site is located along the frontage of **Work No. 9** (Temporary Construction Area off Laporte Road).

18.6.42 The breach modelling is based on the Still Water Tidal Levels from the Northern Area Tidal Mapping Study including a 100 % (1 in 1) AEP wave height allowance.

18.6.43 The Breach Hazard Mapping shows the following:

a. For a 2006 (current day) 0.5% AEP breach event the development is located across 'Significant' and 'Extreme' hazard areas with a maximum water depth of between 1- 1.6m and a maximum velocity of between 0.3-1.0 m/s.

b. For a 2006 (current day) 0.1% AEP breach event the development is predominantly located in the 'Extreme' hazard area with a maximum water depth of between 1- 1.6m, increasing to greater than 1.6m directly behind the flood defences and areas of low topography within the Site, and a maximum velocity of between 0.3-1.0 m/s.

18.6.44 The Environment Agency has provided additional breach data information for the Site based on the modelling outputs. The maximum breach flood water level for the Site for a 0.5% AEP event is 5.5m AOD and for a 0.1% AEP event this increases to 5.6m AOD. Both breach events have an approximate time to inundation from the modelled locations of less than 2 hours.

Residual Risk – Overtopping of Defences

18.6.45 The Northern Area Tidal Mapping Study also included the modelled representation of current baseline tidal overtopping along the east coast and the south bank of the Humber Estuary. Overtopping of the flood defences has the potential to occur when wave heights exceed the Still Water Tidal including a 100 % (1 in 1) AEP wave height allowance.

18.6.46 The Overtopping Hazard Mapping shows the following:

a. For a 2006 (current day) 0.5% AEP overtopping event the eastern area of the Site is located across 'Low' and 'Moderate' hazard areas with a maximum water depth of between 0-0.5m and a maximum velocity of between 0-1.0 m/s. The Pipeline Corridor and the western area of the Site are not located within a hazard area.

b. For a 2006 (current day) 0.1% AEP breach event the eastern area of the Site is located across 'Low', 'Moderate' and 'Significant' hazard areas with a maximum water depth of between 0.3-1.0m, and a maximum velocity of between 0.3-1.0 m/s.

Flood Risk from Fluvial Sources

18.6.47 Fluvial flooding occurs when the capacity of a river is exceeded either due to high flows from the catchment draining into the river or a combination of high flows and high tides, which causes raised water levels due to backwater effects.

18.6.48 The FMfP, refer to **Figure 18.2 [TR030008/APP/6.3]** illustrates that the Site is located predominantly within Flood Zone 3a (high risk of flooding) defined as land having a >1 %/ 0.5 % AEP (greater than a 1 in 100/ 1 in 200 chance in any year) of river or sea flooding.

18.6.49 The FMfP does not differentiate between the tidal and fluvial sources of flood risk, however, due to the proximity of the Humber Estuary and the tidal flood defences not being taken into account on the FMfP, the Flood Zone 3 extent represents flooding from predominantly tidal sources along the East Coast and Humber Estuary.

18.6.50 Flood risk from fluvial sources, when considered in isolation from tidal flooding, is not represented on the Environment Agency FMfP along the South Humber Bank. However, mapping in Section 2.4 of the North East Lincolnshire Preliminary Flood Risk Assessment ("PFRA") (Ref 18-36) gives some indication of fluvial flood zones and suggests that the Site is located in Flood Zone 1.

Main Rivers

18.6.51 The closest Main River to the Site is the North Beck Drain, situated immediately south of the Site Boundary.

18.6.52 The Environment Agency have confirmed that the existing fluvial defences reducing the risk of flooding from the Main River along the North Beck Drain consist of earth embankments. They are in fair condition and reduce the risk of flooding to a 2% (1 in 50) chance of occurring in any year. The Environment Agency inspect these defences routinely to ensure potential defects are identified.

Modelled Water Levels

18.6.53 Modelled flood water levels for the North Beck Drain from the Stallingborough and Oldfleet 2020 model have been provided by the Environment Agency. For the 1% AEP event, maximum modelled flood water levels are 2.52 – 2.55m AOD. The water also remains in channel for both the 0.5% AEP flood event.

18.6.54 The Environment Agency Asset Management Database identifies that the flood defence embankments levels along the North Beck Drain are between 3.85m – 3.94m AOD adjacent to the Site Boundary. When compared to the modelled flood water levels there is a freeboard of approximately 1.3m, which indicates that the water remains in bank during the 1% AEP event.

18.6.55 During the and 0.1% AEP flood events water remains in channel along the majority of the length of the watercourse, however modelled levels suggest that a small area of Work Area 9, towards the south east adjacent to the watercourse, is located within Flood Zone 2.

18.6.56 Mapping outputs from the Stallingborough and Oldfleet 2020 model show the Site is at low risk of flooding from the North Beck Drain.

Ordinary Watercourses

18.6.57 Ordinary Watercourses include every river, stream, brook, cut, dyke and sluice which do not form part of a Main River network. Where applicable, the Riparian Owner, IDB or LLFA have a lead responsibility for managing the risk of flooding from ordinary watercourses. The location of the identified watercourses is shown on **Figure 18.2 [TR030008/APP/6.3]**.

18.6.58 Habrough Marsh Drain, under the jurisdiction of NELIDB, lies immediately north and north-west of the Site Boundary and coincides with the Port of Immingham boundary. The watercourse flows from west to east adjacent to the Site Boundary and discharges partly to the Humber Estuary and when water levels are high, discharges partly to the North Beck Drain through the Immingham Pumping Station.

18.6.59 Immingham Pump Drain lies south-west of the Site Boundary and receives flows from Habrough Marsh Drain when water levels are high. Water in the Immingham Pump Drain discharges into the North Beck Drain via the Immingham Pumping Station.

18.6.60 The area surrounding the Site is drained via a network of small land drainage ditches that convey surface water from the surrounding greenfield areas located between the Project and the Humber Estuary.

Modelled Water Levels

18.6.61 Habrough Marsh Drain and the smaller watercourses have no associated hydraulic model or modelled flood water data available to inform the assessment. As a proxy, for catchment areas less than 3km^2, the Environment Agency Risk of Flooding from Surface Water ("RofSW") maps, primarily used to represent surface runoff; can also be used to identify flooding from Ordinary Watercourses. RofSW mapping (refer to **Figure 18.3 [TR030008/APP/6.3]**) identifies that the Habrough Marsh Drain largely remains in bank, with small, localised extents out of bank during higher return periods adjacent to the East Site and Pipeline Corridor.

18.6.62 The smaller drains across the Site also largely remain in bank, with small, localised extents out of bank during higher return periods within the West Site and East Site.

18.6.63 The NELC SFRA (Ref 18-18) states that "*the drainage system managed by the NELIDB is understood to be able to accommodate events with 0.1% AEP by a combination of storage and pumping, without flooding the surrounding area*".

18.6.64 The risk of fluvial flooding to the Project is considered to be low.

Residual Risk – Tide-locking

18.6.65 Tide-locking is a common problem in watercourses where defences occur. Habrough Marsh Drain (Ordinary Watercourse) and North Beck Drain (Main River) are both gravity drainage systems with a flapped outfall into the Humber to prevent the incoming tide from entering the channel when water levels in the Estuary are high. When high tides prevent the watercourses from discharging into the Humber Estuary, water levels within the drains increase temporarily until the tidal level has decreased sufficiently to allow the outfall to operate again.

18.6.66 Correspondence with the NELIDB (Annex 1 of **Appendix 18.A FRA [TR030008/APP/6.4]**) indicates that when there are high water levels in the Habrough Marsh Drain, the Habrough Slide control structure allows water to discharge via the Immingham Pump Station when the gravity system is tide locked, but only if there is capacity available in the pumped system. The NELIDB note that the Habrough Marsh Drain during events when it is tide locked backs up with increasing water levels and can cause 'out of bank' flooding. The IDB have not stated if flooding from the Habrough Marsh Drain occurs in proximity to the Site, however, the NELC LFRMS (Ref 18-37) and SFRA (Ref 18-18) indicate that flooding is more prevalent in the upstream region of the watercourse rather than near the Site itself.

18.6.67 Areas of the Site located directly adjacent to Habrough Marsh Drain are at residual risk of fluvial flooding during tide-locking events.

Residual Risk – Failure of Immingham Pumping Station

18.6.68 Should Immingham Pumping Station fail, water from the Immingham Pump Drain would be unable to discharge to the North Beck Drain and, similar to the tide-locking scenario, water levels within the drains would increase temporarily until such a time that the pumping station is repaired and operational.

18.6.69 There is potential for flooding from Immingham Pump Drain and Habrough Marsh Drain (the drain discharges to Immingham Pump Drain when water levels are high) to the Site along the areas directly adjacent to the Site and surrounding land.

Groundwater Flooding

18.6.70 Groundwater flooding occurs when water levels in the ground rise above surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks (aquifers).

18.6.71 The NELC SFRA (Ref 18-18) states "*Generally the risk of flooding from groundwater is in the coastal areas from Immingham to Humberston, i.e. the lower lying parts of the Borough. This is caused by artesian spring flows from confined chalk where high groundwater pressures force an upward flow path through the confining clay*" (Page 26).

18.6.72 Groundwater levels tend to get re-charged during the winter and high groundwater levels can cause flooding as the water table rises. This rise in water table levels can be very slow, dependent on rainfall patterns. There is no reference to groundwater flooding events in the NELC SFRA (Ref 18-18) for the Eastern Coastal Area where the Project is located.

18.6.73 There are no historical flood records of groundwater flooding within the Site or the wider Port of Immingham area.

18.6.74 **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** provides details of the geology and hydrogeology at the Site.

18.6.75 Previous ground investigations undertaken at the Site are summarised in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** which indicate that perched groundwater is present within all geological units beneath the Site. Groundwater has previously been encountered in the Tidal Deposits beneath the East Site between 1.63m AOD and 3.97m AOD. Within the corridor area groundwater was struck at between 16 – 18 m below ground level ("bgl") with groundwater seepage encountered in boreholes and test trenches between 1.7m bgl – 4m bgl.

18.6.76 The Immingham Ammonia Import Terminal Ground Investigation Report (**Appendix 21.B Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**) provides details of fieldwork undertaken at the Site between 8 November 2022 and 16 February 2023 (with groundwater monitoring continuing to May 2023.

18.6.77 The groundwater level monitoring data indicates that groundwater is present in all geological units beneath the Site. Perched groundwater was encountered within Made Ground, mostly within the East Site. No monitoring boreholes were installed within Made Ground in the West Site. Groundwater levels within Made Ground varied between ground level and 2.5m bgl. The groundwater levels in boreholes screened within Tidal Flat Deposits within the East Site varied between 3.3.97m OD to 1.63m OD. Groundwater levels within Glacial Till Deposits varied between 0.5m OD and 1.06m OD in the West Site and 1.82m OD and 2.65m OD in the East Site. Groundwater levels within monitoring wells within the Flamborough Chalk Formation varied between 0.72m OD and 3.1m OD in the East Site. All nine Chalk monitoring boreholes installed recorded artesian conditions during the monitoring period, except W-BH17 which recorded slightly lower levels (up to 1.46m bgl) on two occasions.

18.6.78 The groundwater generally flows in a north-easterly direction towards the Humber Estuary.

18.6.79 Given the information on groundwater and potential for groundwater flooding in the area, the baseline condition for the risk of flooding from groundwater sources at the existing Site is currently assessed as a medium risk.

Surface Water (Pluvial) Flooding

18.6.80 The Environment Agency RoFSW maps (accessed online 26 May 2023) indicate areas at risk from surface water flooding when rainwater does not drain away through the normal drainage systems or soak into the ground, but instead lies on or flows over the ground.

18.6.81 The risk of surface water is defined by the Environment Agency, with these risks being defined in accordance with **Table 18-10**.

Table 18-10: Definition of Risk from Surface Water Flooding

Risk of flooding	Definition
Very low	Each year, the area has a chance of flooding of less than 1 in 1000 (0.1%).
Low	Each year, the area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).
Medium	Each year, the area has a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).
High	Each year, the area has a chance of flooding greater than 1 in 30 (3.3%).

18.6.82 The RoFSW map (**Figure 18.3 [TR030008/APP/6.3]**) identifies the vast majority of the Site as at 'very low' risk of surface water flooding (<0.1% AEP event). Small areas along the roads and along adjacent land drains within the Site are identified to be at a 'low', 'medium' and 'high' risk from surface water flooding (>0.1% AEP, 3.3% to 1% AEP event and >3.3% AEP event respectively).

18.6.83 Within the West Site (**Work No. 7**), there is ponding during higher return period events and there are isolated areas at 'low', 'medium' and 'high' risk of surface water flooding within the East Site (**Work Nos. 3 and 5**) and temporary construction area (**Work No. 9**). These areas at risk are considered to reflect areas at topographic low points.

18.6.84 Additionally, this information is supported by the fact that there are no significantly raised ground levels adjacent to the Site that could generate sufficient rates/ volumes of surface water runoff to pose a risk of overland flow coming onto the Site. No overland flow routes into or across the Project Site have been identified on the RoFSW map.

18.6.85 The risk to the Site from overland flow of surface water generated adjacent to the Site, or from waterbodies located within the Site is considered to be 'low', 'medium' and 'high' in small areas, but largely 'very low'.

Flooding from Artificial Sources

Reservoirs

18.6.86 Reservoir failure can be particularly dangerous as it causes the release of large volumes of water at a high velocity, which can result in deep and widespread flooding. However, reservoir inspection and design procedures are very rigorous such that the probability of failure is generally regarded as extremely low.

18.6.87 The Environment Agency has produced maps based on mathematical modelling showing the extent of flooding in the unlikely event of large reservoir breaching in England and Wales (accessed online May 2023). The Environment Agency Long-Term Flood Risk Map shows the Site is not at risk of flooding from reservoir failure. Flooding from reservoirs is therefore not considered further in this assessment.

Canal Systems

18.6.88 Canals do not pose a direct flood risk given they are regulated water bodies with controlled water levels; however, flooding can still occur through a breach or overtopping. Control structures such as weirs or locks could experience a blockage or failure resulting in rising water levels and overtopping. Structural failure could lead to a breach which can potentially be hazardous as they may involve the rapid release of large volumes of water at high velocity.

18.6.89 A review of the Canal and River Network Mapping from the Canal and River Trust indicates there are no active canal systems in proximity to the Project. As such, there is no flood risk posed to the Project Site from this source. Flooding from canals is therefore not considered further in this assessment.

Flooding from Drainage Infrastructure

18.6.90 Flooding from drains, sewers and surface water can be interconnected. Insufficient or reduced drainage capacity within the sewer network can result in drainage capacity being exceeded causing extensive surface water flooding. Likewise, increased volumes of surface water can overload sewers and drains, causing the drainage network to backup and surcharge causing surface water flooding.

Existing Drainage Infrastructure

18.6.91 Anglian Water asset mapping shows there is no surface water drainage infrastructure for which Anglian Water have responsibility located within the Site. Drainage of surface water and foul water within the wider Port of Immingham is privately owned and does not discharge to the wider Anglian Water surface water or foul water drainage network beyond the Port of Immingham.

18.6.92 The following Anglian Water assets are present in the proximity to the Site:

a. A domestic sewer beneath Kings Road.

b. A trade effluent sewer beneath Queens Road.

c. A domestic sewer beneath the access road to a Water Treatment Works.

d. A Water Treatment Works, located to the south of the Long Strip, accessed off Queens Road.

e. Final effluent sewer from the Water Treatment Works, passing under the main Temporary Construction Area and discharging to the Humber Estuary via the Immingham Sea Outfall located at OS NGR TA2141715599, downstream of the Port of Immingham.

18.6.93 There are no predicted morphological changes in or around the outfall due to changes to physical processes in the Estuary. Further details are provided in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

18.6.94 Discussions with NELIDB to inform the outline drainage strategy for the Site indicate that the Site drains via infiltration to the local watercourses and land drains. The Site drains predominantly to the south to the North Beck Drain via local land drains or via the Immingham Pump Drain.

18.6.95 The East Site is considered a formerly developed brownfield land. The East Site (**Work No. 3**) appears to not have any impermeable surface but was likely a stockpile area and may have been compacted or paved previously. The East Site (**Work No. 5**) is artificially raised and contains a drainage system.

18.6.96 The West Site (**Work No. 7**) is considered as undeveloped land and is crossed by local watercourses forming part of the wider managed low land drainage network. These discharge to the existing drainage ditch along the southern boundary.

18.6.97 Further details on existing drainage are provided in **Appendix 18.B Drainage Strategy [TR030008/APP/6.4]**.

18.6.98 As part of the NELC SFRA (Ref 18-18), Anglian Water provided records from their Floods Registers which are used to record flood incidents attributable to their sewer networks, whether that be from foul and/ or surface water sewers. The historical mapping, included within the SFRA, shows that the Site is not located in an area that is known to flood from sewer networks.

18.6.99 In addition, there are no historical records of flooding from the private drainage system within the wider Port of Immingham and the lack of drainage infrastructure within the Site suggests a limited probability of flooding from this source.

18.6.100 On the basis of the available information, the Site is considered to be at low risk of flooding from drainage and sewerage infrastructure.

Future Baseline

18.6.101 The future baseline is a prediction of baseline conditions in the future, assuming that the Project is not constructed. In the absence of the Project, it is anticipated that future baseline conditions would be similar to the existing baseline as described above, subject to the caveats detailed below.

18.6.102 Generally, there is an improving trend in water quality and the environmental health of waterways in the UK since the commencement of significant investment in sewage treatment in the 1990s, the adoption of the WFD from 2003, and the application of ever more stringent planning policies. In terms of water quality impacts, the future baseline assumes that all WFD waterbodies achieve their planned target status by 2027.

18.6.103 With regards to future water use, there are expected to be other developments around the North East & Yorkshire Net Zero Hub which may have water needs but at present few of these projects have been consented. In the case of those that have been, their supplies will most probably come from the proposed 59 Ml/d non-potable water supply Anglian Water have dedicated within the South Humber Bank Water Resource Zone for developments. Where small amounts of potable supplies are required, these will have been accounted for in the Water Companies' WRMPs.

18.6.104 In the future baseline scenario (taken as 2100 (75 years lifetime of the development) based on requirements of the NPPF), the existing coastal defence and drainage structures would be maintained and improved, as appropriate, and hydrodynamic and sedimentary processes will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns, and trends (e.g. ongoing maintenance dredging and disposal).

18.6.105 The future baseline will also be influenced by climate change. It is anticipated that the impact of climate change will include:

a. Changes in storminess/storm surges, wave heights, and sea levels, posing an increased risk of coastal damage and tidal flooding.

b. Changes in rainfall intensity increasing peak river flows, posing an increased risk of fluvial flooding and property damage.

c. Changes in rainfall intensity increasing surface water runoff (overland flow), posing an increased risk of pluvial and drainage/sewer flooding.

18.6.106 An increase in both tidal and fluvial water levels will occur as a consequence of climate change (climate change is assessed over a 75-year period for non-residential development in line with the NPPF). It is estimated that tidal water levels will increase by 0.85 m (based on the higher central climate change allowance) and fluvial peak flows in North Beck Drain, Habrough Marsh Drain, Immingham Pump Drain and the local drainage ditches will increase by 12% by 2115 (based on the higher central peak river flow allowance).

18.6.107 In addition, rainfall intensity will increase by up to 40% by the year 2125 placing increased pressure on drainage infrastructure and increasing the risk of surface water flooding.

18.6.108 It is likely that through the action of new legislative requirements and more stringent planning policy and regulation, the health of the water environment will continue to improve post-2027. However, there are significant challenges such as adapting to a changing climate (i.e. in general drier summers, wetter winters, and an increased frequency of significant storms are forecast for the UK); and the pressures of population/economic growth could have a retarding effect on the water environment if it is not managed carefully through the design of projects, mitigation and the maintenance of mitigating solutions. However, it is difficult to forecast these changes to water quality with any certainty.

18.6.109 The design life of the landside development (the hydrogen production facility) is 25 years however the terminal (the jetty and related topside infrastructure) would likely be retained beyond this 25 year timeframe and become part of the permanent port infrastructure, refurbished accordingly as required. Following the guidance in the PPG (Ref 18-14) the lifetime of the development has been assessed as 75 years (taken from the commencement of Phase 1 of the Project in 2025). The flood risk future baseline is therefore taken as the year 2100. This provides a conservative approach to the assessment of flood risk to and from the development.

Importance of Receptors

18.6.110 The importance of the local water resource receptors within the Study Area is described in **Table 18-11**. Importance is based on the criteria outlined above in **Table 18-3**. Note that the Humber Estuary is considered within **Chapter 17: Marine Water and Sediment Quality** [**TR030008/APP/6.2**].

Table 18-11: Importance of Receptors

Receptor	Importance Descriptions
North Beck Drain (Water Quality)	The importance of the North Beck Drain is considered to be Low, this is a non-WFD surface water body with limited aquatic fauna and biodiversity with no associated economic or social use.
North Drain (Flood Risk)	The importance of the North Beck Drain is considered to be High with regards surface water drainage. The watercourse drains low lying land and is part of the local pumped drainage network.
Habrough Marsh Drain (Water Quality)	The importance of the Marsh Drain is considered to be Low, this is a non-WFD surface water body with limited aquatic fauna and biodiversity with no associated economic or social use.
Habrough Marsh Drain (Flood Risk)	The importance of the Habrough Marsh Drain is considered to be High with regards surface water drainage. The watercourse drains low lying land and is part of the local pumped drainage network.
Immingham Pump Drain (Water Quality)	The importance of the Pump Drain is considered to be Low, this is a non-WFD surface water body with limited aquatic fauna and biodiversity with no associated economic or social use.
Immingham Pump Drain (Flood Risk)	The importance of the Immingham Pump Drain is considered to be High with regards surface water drainage. The watercourse drains low lying land and is part of the local pumped drainage network.
Land Drainage Network (Water Quality)	The importance of the unnamed drains which in the vicinity of the Site constitute the Land Drainage network is considered to be Low, these are non-WFD surface water bodies with limited aquatic fauna and biodiversity with low associated economic or social use.
Land Drainage Network (Flood Risk)	The importance of the Land Drainage Network is considered to be Medium with regards surface water drainage. The small drainage ditches form part of a localised drainage network.
Construction workers/Site Operatives	Construction workers and site operatives are considered to be of High Importance. Construction workers and operatives on-site are at risk as human health receptors due to the proximity to flood risk sources. However, given prior knowledge of site conditions there is an increased awareness of flood risk issues and evacuation procedures
Site Visitors	Site visitors are considered to be of Very High Importance. Visitors on-site are at risk as human health receptors due to the proximity to flood risk sources but have little/no prior knowledge of site conditions or awareness of flood risk and evacuation procedures.

Receptor	Importance Descriptions
Flood Defences	The importance of the flood defences is considered to be Very High as the defences provide protection from tidal flooding to a significant area along the South Humber Bank
Proposed Development	The landside development aspects of the Project are considered to be receptors of Very High Importance as it is classified as Essential Infrastructure under both the NPSfP and NPPF. The marine side aspects of the Project are considered to be Water Compatible and therefore a receptor of Low Importance.
Existing development off-site	Existing development off-site consists of port related storage/ commercial/ industrial and residential use classified as a mixture of Less Vulnerable/ More Vulnerable, Water Compatible and Essential Infrastructure development. Dependent of the flood risk vulnerability classification the importance of the receptors ranges from Low to Very High.
Coastal and floodplain grazing marshes	These areas of good quality semi-improved grassland, although not designated, they are in terms of water quality a Low importance receptor.

Floodplain Importance for Impact Assessment

18.6.111 For the construction assessment, the key receptor in terms of all forms of flood risk are the construction workers who would be present on Site and who are considered to be of High Importance. It is considered that the risk to surrounding residential, commercial and ecological receptors arising from construction of the Project is no greater than in the baseline scenario.

18.6.112 For the operational assessment, the importance of the receptors is based on understanding of the receptors present within areas at risk of flooding (i.e. the Project and other infrastructure) and the existing risk of flooding from all sources. The floodplain around the Humber in the Study Area and the entirety of the Project is in Flood Zone 3a, where importance of the floodplain for impact assessment purposes is considered High. The Project, in EIA terms, is of Very High importance to tidal and fluvial flooding due to of the classification as essential infrastructure (see **Table 18-2**).

18.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

18.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to water quality, coastal protection, water use flood risk and drainage through the process of design development, and by embedding mitigation measures into the design.

18.7.2 One of the project objectives is water conservation. The majority of the Project demand is for non-potable water for process cooling. Within the Project design various water reduction and reuse measures have been incorporated based on BAT and also water re-use potential. Embedded measures include use of

recirculating cooling water system rather than once pass though cooling water, reuse and segregation of water streams and process control of chemical dosing and cooling water and boiler blow down systems

18.7.3 In line with best practice, the following flood resilience measures would be used in the design of the Project to minimise the amount of damage and reduce recovery time in the unlikely case of the site becoming inundated:

a. Finished floor level raising.
b. Use of flood resistant building materials.
c. Use of water-resistant coatings
d. Use of galvanised and stainless-steel fixings.
e. Raising electrical sockets and switches.
f. Provision of an appropriate safe refuge.

18.7.4 The resilient construction measures listed above would be included in the Project design during both the construction and operational phases and have been taken into account in the assessment.

18.7.5 Further details regarding the management of flood risk are presented within Section 6.9 of the FRA at **Appendix 18.A [TR030008/APP/6.4]**.

Water Use

Non-potable Water

18.7.6 The operational Project is estimated to require approximately 3,640m^3 /day of non-potable water to support the hydrogen production facility. The non-potable supply is primarily required to provide cooling water makeup.

18.7.7 The hydrogen production facility would also require non-potable water for periodic use including fire water storage, utility stations and for Amine solution make-up but these would be small quantities and would not impact the overall water demand.

18.7.8 Agreement has been reached in principle with Anglian Water for the provision of non-potable water to the required standards suitable for use in the site cooling towers for the hydrogen production facility. This water is to be transferred to the site from an existing Anglian Water source. The use of non-potable water for this application will reduce the pressure of the Project on an already water stressed Water Resource zone within the UK. A connection to an existing non-potable water main running the length of Laporte Road would be required through an agreement with Anglian Water (see also the **Utilities Statement**, **[TR030008/APP/7.7]**). The offer received from Anglian Water meets the full requirements for the Project (see **Paragraph 18.7.6**). It is assumed that in order to make this offer, Anglian Water would have taken account of their choice of source selection in any longer-term Water Resources Management Planning context.

Potable Water

18.7.9 The operational Project would also require a limited potable water supply for offices (including fire sprinkler systems), welfare facilities and site safety showers. The potable supply is expected to be drawn from the existing mains water supply through a connection in Kings Road (for West Site, Work No. 7), Laporte Road (for East Sites and jetty, Work No.s 1, 3 and 5) (see the **Utility Statement**, **[TR030008/APP/7.7]**). The potable supply would be sized by Anglian water based on number of future users and subject to a separate agreement (from the non-potable supply) with the Company.

Standard Mitigation Measures

18.7.10 Standard mitigation measures have been identified for implementation by the contractor during the construction, operation and decommissioning phases of the Project. Throughout all Project phases, the contractor will be required to comply with all relevant Health and Safety legislation when undertaking works, activities and operations within the Site.

Construction Phase

18.7.11 During construction, water pollution may occur directly from spillages of polluting substances into waterbodies, or indirectly by being conveyed in runoff from hard standing, other sealed surfaces or from construction machinery. Fine sediment may also be disturbed in waterbodies directly or also wash off working areas and hard standing (including approach roads) into waterbodies indirectly via existing drainage systems or overland. Due to past industrial activity, this sediment may not be inert and may potentially contain contamination that could be harmful to the aquatic environment. However, potential impacts to the water environment during the construction phase would tend to be temporary and short term.

18.7.12 An **Outline CEMP** has been prepared as part of the DCO application **[TR030008/APP/6.5]**. This document describes the measures identified to limit uncontrolled run-off and accidental releases of potential contaminants together with measures to manage flood risk from all sources. Example measures are summarised in the sections below.

18.7.13 The contractor will be required to prepare a final Construction Environmental Management Plan. The final CEMP would outline the measures necessary to avoid, prevent and reduce adverse effects where possible upon the local surface water environment. These measures would be detailed further within a Water Management Plan (“WMP”) that would form a technical appendix to the final CEMP.

18.7.14 The final CEMP would be reviewed, revised and updated as the Project progresses towards construction to ensure all potential impacts and residual effects are considered and addressed as far as practicable, in keeping with available good practice at that point in time.

18.7.15 The principles of the mitigation measures set out below are the minimum standards that the Contractor would implement. However, it is acknowledged that for some issues, there are multiple ways in which they may be addressed. In addition, the methods of dealing with pollutant risk would need to be continually reviewed on Site and adapted as construction works progress in response to different types of work, weather conditions, and locations of work.

18.7.16 The potential for adverse impacts would be avoided, minimised and reduced by the adoption of the general mitigation measures which are outlined in the following sections, and which will be described in the WMP in the final CEMP.

Best Practice Guidance

18.7.17 Best practice guidance and mitigation measures will be adhered to during construction, in order to prevent or minimise spillage risks and impacts on the water environment during the construction phase. The measures also address treatment and disposal of wastewater, dewatering, accidental spillages associated with building construction, foundations, concrete usage and the management of concrete batching.

18.7.18 The following relevant Guidance for Pollution Prevention ("GPPs") have been released to date on the NetRegs website (NetRegs, n.d.) and are listed below. While these are not formal regulatory guidance in England, it is a useful resource for best practice to inform the CEMP.

a. GPP 1: Understanding your environmental responsibilities – good environmental practices.
b. GPP 2: Above ground oil storage.
c. GPP 3: Use and design of oil separators in surface water drainage systems.
d. GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer.
e. GPP 5: Works and maintenance in or near water.
f. GPP 8: Safe storage and disposal of used oils.
g. GPP 13: Vehicle washing and cleaning.
h. GPP 19: Vehicles: Service and Repair.
i. GPP 20: Dewatering underground ducts and chambers.
j. GPP 21: Pollution Incident Response Plans.
k. GPP22: Dealing with spills.
l. GPP26: Safe storage – drums and intermediate bulk containers.

18.7.19 Where new GPPs are yet to be published, previous Environment Agency Pollution Prevention Guidance ("PPGs") provide useful advice on the management of construction to avoid, minimise and reduce environmental impacts, although they should not be relied upon to provide accurate details of the current legal and regulatory requirements and processes. Construction phase operations would be carried out in accordance with relevant guidance contained within the following PPG:

a. PPG6: Working at construction and demolition sites.

b. PPG7: Safe storage – the safe operation of refuelling facilities.

c. PPG18: Managing fire water and major spillages.

18.7.20 Additional good practice guidance for mitigation to protect the water environment can be found in the following key CIRIA documents and British Standards Institute documents:

a. British Standards Institute (2009) BS6031:2009 Code of Practice for Earth Works.

b. British Standards Institute (2013) BS8582 Code of Practice for Surface Water Management of Development Sites.

c. C753 (2015) The SuDS Manual (second edition).

d. C744 (2015) Coastal and marine environmental site guide (second edition).

e. C741 (2015) Environmental good practice on site guide (fourth edition).

f. C648 (2006) Control of water pollution from linear construction projects, technical guidance.

g. C609 (2004) Sustainable Drainage Systems, hydraulic, structural and water quality advice.

h. C532 (2001) Control of water pollution from construction sites – Guidance for consultants and contractors.

Management of Construction Site Run-off

18.7.21 There are a wide range of measures that can be adopted by the Contractor to reduce the risk of excessive fine sediment in runoff (timing of works, minimising earthworks and seeding or covering them), to intercept runoff to prevent uncontrolled runoff from the Site (e.g. by using cut off drains, fabric silt fences, bunds and straw bales, designated areas for cleaning plant and equipment, wheel washes and road sweepers), and to treat runoff to remove excessive levels of fine sediment (e.g. settlement lagoons, sumps, spraying on to land or even proprietary measures such as lamella clarifiers).

18.7.22 Temporary drainage facilities will be provided within the Work No. areas, including the Temporary Construction areas (including around the concrete batching plant in the East Site (Works No.5a), throughout the construction phases, where necessary, to ensure controlled discharge of surface water run-off. Measures that would be considered for temporary drainage include:

a. Installation of measures such as swales, silt fences and appropriately sized settlement tanks/ ponds to reduce sediment load.

b. Cut-off ditches or geotextile silt-fences, installed around excavations, exposed ground.

c. Stockpiles to prevent uncontrolled release of sediments from the proposed development.

d. Site access points will be regularly cleaned to prevent build-up of dust and mud.

e. A valve will be installed to isolate the settlement tank/ ponds in the event of a polluted discharge.

f. Oil interceptors to be installed (notably the outflow from the settlement pond/ tank) to reduce the potential risk for contamination of groundwater and surface water.

18.7.23 It would be for the Contractor to continually monitor the need for measures depending on the nature of the works being undertaken the weather conditions, and the performance of sustainable drainage systems installed.

Management of Construction Spillage Risk

18.7.24 Best practice guidance and mitigation measures would be implemented to manage the risk of accidental spillages on site and potential conveyance to nearby waterbodies via surface runoff or land drains. These measures relating to the control of spillages and leaks are summarised in the **Outline CEMP [TR030008/APP/6.5]** and would be included in the WMP in the final CEMP and adopted during the construction works. Measures would be in accordance with prevailing pollution prevention legislation and following best practice guidance summarised earlier. They would include details of how fuel and other chemicals (including cement) would be stored, used on site, and equipment and plant cleaned, as well as how leaks and spillages would be prevented or remediated if needed. This would also include the implementation of a Pollution Prevention Plan and an Emergency Response Plan. In addition, any site welfare facilities would be appropriately managed, and all foul waste disposed of by a licensed contractor to a suitably permitted facility.

18.7.25 Measures include:

a. Containment measures will be implemented, including drip trays, bunding or double-skinned tanks of fuels and oils; all chemicals will be stored in accordance with their Control of Substances Hazardous to Health (“COSHH”) guidelines, whilst spill kits will be provided in areas of fuel/ oil storage.

b. An Emergency Spillage Plan will be produced, which site staff will have read and understood.

c. The mixing and handling of materials will be undertaken in designated areas and away from surface water drains.

d. Plant and machinery will be kept away from surface water bodies wherever possible and will have drip trays installed beneath oil tanks/ engines/ gearboxes and hydraulics, which will be checked and emptied regularly. Refuelling and delivery areas will be located away from surface water drains.

18.7.26 **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] and Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** discuss further standard mitigation measures to be implemented in order to prevent and minimise potential pollution to surface watercourses, including the use of an oil spill contingency plan and spill kits on site.

Management of Flood Risk

18.7.27 Temporary Construction Areas for laydown and construction compounds (**Work No. 8** and **Work No. 9**) would be suitably enclosed with fencing in order to stop construction plant etc becoming buoyant and floating away should flooding from a breach or overtopping event occur.

18.7.28 Within the Temporary Construction Area (**Work No.9**) an 8m clear strip from the landward toe of the fluvial defence along the North Beck Drain will be retained to allow for maintenance and access by the Environment Agency. Any compound or storage area located within the Temporary Construction Area (Work No.9) would therefore be located further than 8m from the landward toe and outside of the area shown to be located in Flood Zone 2 to the south of the Temporary Construction Area.

18.7.29 Construction materials would be suitably stored in line with best practice and COSHH/COMAH regulations. In the event of extreme weather and a flood warning being in place works would be stopped and construction plant would be removed from the Site for the duration of the flood warning event.

18.7.30 During the construction phase, the Contractor would monitor weather forecasts on a monthly, weekly and daily basis, and plan works accordingly. For example, works adjacent to the flood defences, works adjacent to the channel of any watercourse etc would be avoided or halted were there to be a risk of high flows or even flooding. In addition, the Contractor would sign up to Environment Agency flood warning alerts and produce an Emergency Response Plan which details the actions it would take in the event of a possible flood event. These actions would be hierarchal meaning that as the risk increases the Contractor would implement more stringent protection measures. This is important to ensure all workers, the construction site and third-party land, property and people are adequately protected from flooding during the construction phase.

18.7.31 Works adjacent to the flood defences or within or adjacent to the channel of any watercourse will require a Flood Risk Activity Permit (works within 16m of tidal flood defences or tidal Main River, within 8m of a fluvial Main River) or Ordinary Watercourse consent (within 9m of an Ordinary Watercourse) in line with NELIDB drainage byelaws. The Applicant is in discussion with the NELIDB and the Environment Agency about disapplication of the land drainage consent and Flood Risk Activity Permits within the DCO. See Article 3 of the **draft DCO [TR0300008/APP/2.1]**.

18.7.32 If groundwater is encountered during below ground construction, suitable de-watering methods would be used. A dewatering scheme will be prepared and implemented to manage groundwater arising from the operations and water treatment prior to controlled discharge. Any significant volumes of groundwater dewatering required, dependent on disposal methods, would require an Environmental Permit. Potential for groundwater emergence in excavations

would be assessed prior to commencing works on site to establish volumes and points of discharge, and ultimately any residual flood risks.

18.7.33 Safe egress and exits would be maintained at all times when working in excavations. When working in excavations a banksman would be present at all times.

18.7.34 All construction workers would undergo site induction training prior to being allowed access onto site. This would include instructions on what to do in the event of emergency incidents such as flooding, access and egress routes and the location of safe refuge, if required.

18.7.35 As part of the proposed works, the standard of protection afforded by the existing flood defences in proximity to the jetty access road and pipe rack would be increased as the crest height of the new section of flood defence wall would be increased to 7.0m AOD.

18.7.36 During the construction period piling will be located a sufficient distance away from the flood defence and designed so that the defence is not adversely affected.

18.7.37 There is one pile proposed through the embankment at the rear of the flood defences. The following surveys and monitoring would be undertaken:

a. A pre, post and a year post construction topographical survey of the defence at monitoring points (cross sections).

b. A pre, post and a year post construction photographic survey of the defence (landward, crest, wall and seaward face).

c. During construction monitoring and notification procedures for structural movement.

18.7.38 Any structural movement or damage to the embankment will be rectified and the Environment Agency notified.

18.7.39 On the landward side, temporary works and contingency measures will be put in place, as necessary, for the construction of the proposed the ramps and new section of flood defence to ensure the continuity of the flood defence throughout the works. The contractor will be required to provide a contingency plan for deployable or temporary flood defence works methods, approved by the Environment Agency, prior to the commencement of the works, or through structuring the works in such a way that the existing defence wall can remain in-situ until the new structure is completed.

18.7.40 Further information will be provided and consultation with the Environment Agency undertaken when the design and construction methods are finalised. Mitigation measures will include a combination of detailed weather forecasting with works only undertaken at low tide and use of temporary barriers. The contractor will be required to have a contingency plan in place, for the deployment of flood protection measures within a timescale agreed with the Environment Agency.

18.7.41 Further details regarding the management of flood risk are presented within the FRA (refer to **Appendix 18.A [TR030008/APP/6.4])**. A requirement of the **draft DCO [TR030008/APP/2.1]** ensures compliance with the FRA during construction

and operation of the Project - the FRA outlines the relevant mitigation measures to be complied with for the purposes of that requirement and in order for the Project to remain safe, should a flood event occur.

18.7.42 Subject to the grant of the DCO, construction of the Project (save certain enabling works) will not be able to commence until the final CEMP has been prepared by the contractor and approved in writing by the Planning Authority. This will be secured by a requirement included in the **draft DCO [TR030008/APP/2.1]** and will contain the measures detailed in the **Outline CEMP [TR030008/APP/6.5].**

Operational Phase Mitigation Measures

18.7.43 The Project will operate in accordance with and comply with relevant legislation and regulations, and the hydrogen production facility will be regulated by the EA through an Environmental Permit.

18.7.44 Appropriate emergency environmental management plans and procedures, in accordance with legislation, regulations and industry best practice, will be in place for the operational stage.

18.7.45 Potential impacts associated with the accidental spillage of polluting materials during the operational phase will be mitigated by way of process monitoring and implementation of an Environmental Management System.

Surface Water Drainage

18.7.46 Sources of potential water contamination from the terminal (**Work No. 1**), the jetty access road and the pipe-rack (**Work No. 2**) would be limited to rainwater falling on any impermeable surfaces. Surface water on the jetty and terminal building would discharge at an unrestricted rate, via over edge drainage, directly into the River Humber. Surface water on the jetty access road would drain directly to the small drainage ditch which is located directly beneath the road corridor where the road rises to pass over the flood defences.

18.7.47 Sources of potential water contamination from the hydrogen production facility would be limited as both liquid ammonia and liquid hydrogen are refrigerated gases. However, the plant would require the use of ammonia solution as well as oil, diesel and water treatment chemicals which are all potential water pollutants. The hydrogen production facility is designed to prevent or minimise fugitive emissions to water. The process equipment would be situated on an impervious hard standing area, which would be subject to regular visual inspection. Liquid chemicals and equipment and associated pipework would be located above ground in an impervious bunded areas sized for 110% of the contents to prevent accidental discharges to groundwater or drains. Containment would be sized to contain the maximum foreseeable fire water event. Leaks or losses from valves pumps etc would be minimised by design of the equipment and by ongoing maintenance. Plans to install cathodic protection on pipework within the pipeline corridor to protect against saline corrosion, will not result in any detectable changes to the surface water quality.

18.7.48 A new surface water drainage network and management system would be provided for the terrestrial areas of the Site that would provide adequate

interception, conveyance and treatment of surface water runoff from buildings and hard standing, with foul systems for welfare facilities and process wastewater generated by the site operations. Gravity drainage would be used wherever practicable. The Pipeline Corridor (**Work No. 6**) linking the East and West Sites would not require additional drainage as it would be installed underground. The drainage system would also hold all design flows within the Site boundary, so there would be no negative impact to the flood risk of areas surrounding the Site. The drainage strategy will also not impact existing underground services. The Drainage Strategy for the operational development is appended at **Appendix 18.B: Drainage Strategy [TR030008/APP/6.4]**.

18.7.49 The proposed surface water drainage system includes the use of SuDS, including permeable gravel beds and retention basins to provide attenuation storage and suitable water quality management for treatment of runoff from impermeable areas where there is a low risk of contamination by any chemicals used by the energy generation processes, to ensure potential adverse effects on water quality and habitat of receiving water bodies are avoided. Further information is provided in **Appendix 18.B: Drainage Strategy [TR030008/APP/6.4]**.

18.7.50 The drainage system would be designed to be inherently safe and protect the local environment from urban diffuse pollutants that may be present. The drainage system would segregate clean surface water, oily water and water that may have contamination from liquid chemicals (water treatment chemicals, or amine solution). Contaminated or potentially contaminated water would be directed to the on-site package treatment plant or, in the case of amine contaminated water, to off-site disposal. All effluent from the Site would be collected prior to discharge and only discharged if consent requirements are met.

18.7.51 Sanitary waste water from welfare facilities on the jetty and the jetty control room will be collected in cess tanks located at the jetty head. The land side development will be drained via conventional foul sewer and treated through the local sewage treatment work. The Project's sewerage requirements in respect of the number of users has been provided to Anglian Water.

Management of Hazardous Substances on Site

18.7.52 As stated above, sources of potential water contamination would be limited as both liquid ammonia and liquid hydrogen are refrigerated gases. However, the plant would require the use of ammonia solution as well as oil, diesel and water treatment chemicals which are all potential water pollutants. The use of the chemical products at the Site would follow relevant product-specific environmental guidelines, as well as the legislative requirements set out in the Control of Substances Hazardous to Health Regulations.

18.7.53 The storage of hazardous substances during the operational phase will be approved by NELC through a Hazardous Substances Consent and regulated by the Health and Safety Executive (as the competent authority) through COMAH. Further information relating to these measures is presented in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

18.7.54 A site Emergency Response Plan (prepared pursuant to Regulation 9 of the COMAH Regulations) would be in place for dealing with emergency situations

involving loss of containment of hazardous substances. This would detail how to contain and control incidents to minimise the effects and limit danger to persons, the environment and property. The Emergency Response Plan would set out the emergency spill control procedure that will include the actions adapted from the Health and Safety Executive's Emergency Response/ Spill Control Technical Measures Document.

18.7.55 Further guidance which would be referenced in the development of the site Emergency Response Plan would include:

a. HS(G)191 Emergency planning for major accidents. Control of Major Accident Hazards Regulations 1999 (Health and Safety Executive, 1999).

b. HS(G)71 Chemical warehousing: the storage of packaged dangerous substances (Health and Safety Executive, 1992).

c. BS 5908: Fire and explosion precautions at premises handling flammable gases, liquids and dusts. Code of practice for precautions against fire and explosion in chemical plants, chemical storage and similar premises (British Standards Institute, 1990).

18.7.56 These measures would also be applicable to ensure protection of the water environment during the Project's decommissioning phase and it is expected that the final DEMP would draw on the same guidance or any further guidance that is developed prior to the decommissioning of the hydrogen production facility.

Flood Risk Management

18.7.57 Mitigation measures to manage the current and future flood risk during operation are described in detail in Section 6.9 of the FRA (**Appendix 18.A [TR030008/APP/6.4]**).

18.7.58 Measures include the evacuation of workforce and vehicles from the Site should a flood warning be in place. In the event of extreme weather and a flood warning being in place the Applicant's approach will be to shut the facility down, make equipment safe and relocate road tankers present on the Site elsewhere. This would be undertaken on a precautionary basis once a flood warning is received.

18.7.59 Provision of safe refuge within the Site (it is currently proposed that the control room building and Toxic Safe Haven building on the West Site, and the control room building on the East Site, will be designated as areas of safe refuge) and the production of a flood response plan for the development to ensure the residual risk to the Site is sufficiently managed and mitigated. A management system will be implemented to respond to a variety of emergency situations both during normal hours (24/7) and over holiday periods.

18.7.60 In order to protect all critical equipment assets on site, where possible these items are elevated above the 2115 0.1% AEP breach flood water level of 6m AOD. It is the intention of the Applicant to shut down the operation of the facility should extreme weather be forecasted and a flood warning is put in place. However, the following pieces of critical equipment have been identified:

a. Boil off gas and flare system.

b. Control systems and electrical switch gear.

c. Pressure relief system.

d. Pressure control feedback and liquid level control (alarm and trip).

18.7.61 It is proposed that the boil off gas and flare system will be constructed in such a way that it remains above the breach flood water level or will be protected from flooding whilst the control systems, electrical switch gear, and alarm and trips for the pressure control feedback and liquid level control are located at height above the maximum flood level.

18.7.62 These mitigation measures would minimise the potential for building damage and ensure the safety of the workforce to an acceptable level.

Decommissioning

18.7.63 The terminal including the jetty (**Work No. 1**) and the jetty access road (**Work No. 2** in part) would be maintained and become part of the long-term port infrastructure and would not be decommissioned. At the end of the design life all above-ground equipment associated solely with the hydrogen production facility (**Work Nos. 3**, **4**, **5**, **6** and **7**) would be decommissioned and removed. At the end of its design life decommissioning of the hydrogen production facility would see the removal of all above ground equipment down to ground level.

18.7.64 It is assumed that all underground infrastructure would remain in-situ; however, all connection and access points would be sealed or grouted to ensure disconnection. The decommissioning impacts are expected to be similar to the construction impacts.

18.7.65 An **Outline Decommissioning Environmental Management Plan** ("DEMP") **[TR030008/APP/6.6]** has been prepared as part of the DCO application to explain how impacts associated with the decommissioning of hydrogen production facility will be minimised or avoided.

18.7.66 The DEMP will consider in detail all potential environmental risks and contain guidance on how risks can be removed, mitigated or managed. This will include details of how surface water drainage should be managed at the Site during decommissioning and demolition.

18.7.67 A final DEMP will be prepared by the demolition contractor, and will contain the measures detailed in the **outline DEMP [TR030008/APP/6.6]**. The final DEMP will be secured by way of requirement in the **draft DCO [TR030008/APP/2.1].**

18.8 Assessment of Likely Impacts and Effects

18.8.1 The sections below consider the potential water environment impacts during Project construction, operation and decommissioning. The potential risks to the water environment may include deterioration in water quality due to contaminants in surface water runoff etc, increased flood risk and over-whelming the drainage network. Such impacts have the potential to lead to a deterioration in water body status (Ref 18-8).

18.8.2 The potential impacts are considered generically first, in the absence of Site context and without any mitigation assumptions, in **Paragraph 18.8.3** to **18.8.14**. The likely impacts are then considered in greater detail from **Paragraph 18.8.15** to determine the likelihood for significant effects to arise, with the assumption that

the mitigation measures defined in **Section 18.7** have been applied to the Project.

18.8.3 **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** considers the in-combination effects relating to the topic of water quality, coastal protection, flood risk and drainage which could arise from the Project.

Pathways

18.8.4 Potential water environment impact pathways associated with the construction phase of the Project without mitigation include:

a. Contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into waterbodies when there are works within or adjacent to them.

b. The effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).

c. The risk of pollution from chemical spillages or fire.

d. Increase in risk to aquatic life from potential water use and discharges to the environment.

e. Floodplain inundation, increased risk of tidal and fluvial flooding to the Project and surrounding area due to loss of floodplain storage.

f. Changes to flow regimes and/or water levels resulting in an increase in flood risk (fluvial, surface water and drainage infrastructure) due to changes in fluvial and overland flow paths, as a result of storing construction materials, earthworks, and changes in land use.

g. Changes to surface water run-off rates and volumes.

h. Changes in tidal regime due to dredging (and associated disposal activity).

i. Exposure to flood water - increased risk to human receptors being exposed to flood water during the construction phase.

18.8.5 Construction activities such as earthworks, excavations, site preparation, levelling and grading operations may result in the disturbance of soils and, potentially, mobilise contamination. Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation, and this sediment could contain contaminants given the past industrial activities within the Site Boundary. Watercourses across the Study Area may also contain contaminated sediments due to the past industry in this area and the limited erosion and conveyance ability of these watercourses. Other potential sources of fine sediment during construction works include water runoff from earth stockpiles, dewatering of excavations (surface and groundwater), mud deposited on site and local access roads, and that which is generated by the construction works themselves or from vehicle washing.

18.8.6 Allowing such substances to enter a watercourse could be in breach of the Environmental Permitting (England and Wales) Regulations 2016 and the Water Resources Act 1991 (as amended), and therefore measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction.

18.8.7 Construction works and topographical changes in Flood Zone 3a also have the potential to increase the rate and volume of surface water runoff, change surface water, fluvial and tidal flow pathways, and increase the risk of blockages in watercourses that could lead to flow being impeded, and a potential rise in flood risk.

Operational Phase

18.8.8 The potential water environment impact pathways during the Project's operational phase are as follows:

a. Potential operational pollution of surface watercourses from accidental spillages.

b. Potential pollution incident from hazardous firefighting chemicals if a fire was to occur on the Site.

c. Floodplain inundation, increased risk of tidal and fluvial flooding to the Project and surrounding area due to loss of floodplain storage.

d. Changes to flow regimes and/or water levels resulting in an increase in flood risk (fluvial, surface water and drainage infrastructure) due to changes in fluvial and overland flow paths.

e. Changes to surface water run-off rates and volumes.

f. Changes in tidal regime due to dredging and development in the marine environment.

g. Exposure to flood water, increased risk to human receptors being exposed to flood water should overtopping or breach of the flood defences occur.

18.8.9 The water supply and foul water requirements for the Project have been shared with the statutory undertakers so that these can be managed accordingly by the public water company and sewage undertaker, Anglian Water. A response received by Air Products from Anglian Water in late July 2023 indicates that a commercial offer has been made which would provide the water needs for the full Project (Phases 1 to 6).

18.8.10 The potential impact from the foul water discharges is not assessed within the ES as the discharges would be collected by the local sewage system and then treated at existing facilities to the required standards, before release to the receiving waterbodies, under existing consents.

18.8.11 Furthermore, water supply and sewage treatment is a highly regulated industry with existing processes and mechanisms to ensure the supply of services for major developments. Statutory requirements are also placed upon statutory wastewater undertakers to upgrade their infrastructure when required, whilst ensuring they operate within requirements of water abstraction licences and water activity permits to discharge to rivers.

Decommissioning Phase

18.8.12 The terminal including the jetty (**Work No. 1**) and the jetty access road (**Work No. 2** in part) would be maintained and become part of the long-term port infrastructure. These elements of the Project would not be decommissioned and therefore impacts related to receptors associated with changes in tidal regime (i.e. flood defences and Habrough Marsh Drain across the intertidal area) will remain as assessed for the operational phase.

18.8.13 At the end of its 25 year design life all above-ground equipment associated solely with the hydrogen production facility (**Work No. 3**, **Work No. 5** and **Work No. 7**) would be decommissioned and removed from the Site. It is assumed that all underground infrastructure (**Work No. 4** and **Work No. 6**) associated with the hydrogen production facility would remain in-situ, however, all connection and access points would be sealed or grouted to ensure disconnection.

18.8.14 On this basis, decommissioning impacts are expected to be limited to waterbodies in close proximity to the Project Site (i.e. Humber Estuary, North Beck Drain, Habrough Marsh Drain and local land drains), and would be similar to the impacts reported for the construction phase, but with fewer earthworks and excavations to manage.

Construction Impacts and Effects

18.8.15 A qualitative assessment of the likely significant effects on surface waterbody and flood risk receptors during the construction of the Project is presented in the following paragraphs.

Unnamed Drainage Channels within the Site

18.8.16 The **WFD Compliance Assessment,** presented in **Appendix 17.A [TR030008/APP/6.4]** indicates that during the construction stages, there would be potential for the overall water quality in the unnamed drainage channels located within the proposed construction areas on the site to be impacted by the proposed activities. The main risks are increased run off carrying sediment and chemical contamination into the drainage channels.

18.8.17 There is limited connectivity between these drains and the North Beck Drain and the risk of adverse effects to the WFD body is considered to be low. These drains outflow into the Humber Estuary where high levels of dilution, as discussed further in **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2],** would disperse any contaminants that have been transported by the drainage channels. With the implementation of standard mitigation measures, which are included within the **Outline CEMP [TR030008/APP/6.5]**, it is reasonable to conclude that the effects to the water environment during construction would be **negligible / minor adverse** are not likely to be significant.

Water Quality impacts to North Beck, Habrough Marsh Drain and Local Drains

18.8.18 There is the potential for the following events to impact on the North Beck, Middle and Marsh drains as a result of the Project and the significance of any such impact and proposed mitigation is considered in the following paragraphs:

a. Direct spillage

b. Runoff contamination

c. Alteration in fluvial and overland flowpaths and potential increase in flood risk

d. Blockage of drains

18.8.19 Direct spillage, whereby contamination from suspended solids or other chemical contaminants may find their way into site runoff or infiltrate to the ground, or may be spilt directly into waterbodies when there are works within or adjacent to them, could have an impact on the North Beck Drain, Habrough Marsh drain and local drains as a result of the construction phase of the Project. Without appropriate mitigation, this impact would be expected to be moderate to major adverse. Mitigation measures, as outlined in **Section 18.7** are detailed in the outline CEMP and include the use of bunded operations and spill kits on Site. Following the implementation of these mitigation measures, the residual effect of direct spillage on the water quality of the North Beck Drain and Habrough Marsh drain and local drains is anticipated to be **negligible/minor adverse** and not significant.

18.8.20 Impacts on these receptors may also arise from runoff contamination, as a result of diffuse urban pollutants (from vehicle tyres, exhausts and chimney stacks) in surface water runoff (that may contain metals, hydrocarbons and inert solids). In the absence of mitigation measures, the effect would be minor/moderate adverse. Mitigation measures, as outlined in **Section 18.7** are detailed in the outline CEMP and include the use of bunded operations for all chemicals and fuels needed on site. Following the implementation of these mitigation measures, the residual effect of runoff contamination, on the water quality of the drains is anticipated to be **negligible/minor adverse** and not significant.

18.8.21 Alterations in fluvial and overland flowpaths, as well as potential increase in flood risk as a result of storing construction materials in the floodplain could also have an impact on water quality by runoff interacting with materials before entering into the North Beck Drain and Habrough Marsh drain and local drains. Without mitigation, this impact is expected to be minor to moderate adverse. Mitigation measures, as specified in the **Outline CEMP [TR030008/APP/6.5]** are therefore required to reduce this potential impact. A specific mitigation measure that will be implemented will be the careful consideration and appropriate siting of areas for the storage of construction materials. With mitigation measures in place, the residual impact will be **negligible/minor adverse** and not significant.

18.8.22 If unmitigated, an increase in materials such as sand and gravels could be transported in runoff from the Site during construction and there would be an increased risk of possible blockage of drains. In the absence of mitigation, this impact is considered to be minor/moderate adverse. A proposed measure to mitigate this impact will be the appropriate management of surface water runoff on site such as soakaways or collection of runoff in settlement ponds for tankering off-site, which is detailed in the **Outline CEMP [TR030008/APP/6.5]**. With the appropriate mitigation in place, the residual effect of the risk of drain blockage as a result of increased materials transported in runoff is **negligible/minor adverse** and not significant.

Water Quality impacts to Coastal and Floodplain Grazing Marsh and Good quality semi-improved grassland

18.8.23 Direct spillage, whereby contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to the ground, or are spilt directly into non-priority habitat when there are works within or adjacent to them could have an impact on coastal and floodplain grazing marsh and good quality semi-improved grassland during the construction phase of the Project. Without appropriate mitigation, this impact is anticipated to be negligible/minor adverse. Impacts could also arise from runoff contamination, whereby diffuse urban pollutants (metals, hydrocarbons and inert solids) escape into surface water runoff. Appropriate mitigation measures for these impacts, as specified within the **Outline CEMP [TR030008/APP/6.5]**, include the use of bunded operations for all chemicals and fuels needed on site, as well as the use of spill kits. Following the implementation of these mitigation measures, the residual effect of direct spillage and runoff contamination on coastal and floodplain grazing marsh and good quality semi-improved grassland is anticipated to be **negligible** and not significant.

Floodplain inundation from flooding sources

18.8.24 During periods of inclement weather there is the potential that flooding to the Site could occur from tidal, fluvial, surface water, groundwater and drainage sources during the construction phase.

18.8.25 The Site and the surrounding area are afforded protection by tidal flood defences up to and including the 0.5% AEP flood event and is therefore considered to be at low risk of tidal flooding. However, the residual risk of site inundation remains should the defences overtop (during a storm surge) or breaching of the defences occur.

18.8.26 Inundation of the floodplain can also cause damage to existing development and construction equipment, and disrupt site operations, both within the Site and the surrounding area. Construction activities, stockpiles of construction material and structures located on the Site has the potential to change flood flow routes, reduce floodplain storage and increase the risk of flooding to residential and commercial receptors on neighbouring sites.

18.8.27 Development under construction for the Project (i.e. within the defined Site Boundary) during the construction phase comprises landside essential infrastructure (assessed as a receptor of very high importance) and marine side water compatible infrastructure (assessed as a receptor of low importance).

18.8.28 Existing development on neighbouring sites comprises mixed use development, including commercial, residential, industrial/warehouse uses, and tanked bulk storage uses with hazardous substance consents etc., assessed as receptors of low importance to very high importance (based on the PPG (Ref 18-14) development vulnerability classifications outlined in **Table 18-11**).

18.8.29 The Site is considered to be at low risk of flooding from all other sources with the exception of groundwater flooding which is assessed as a medium risk. Flooding from these sources, although considered to be temporarily disruptive on site should flooding occur, are not considered significant when compared to the impact of a tidal flood event.

18.8.30 The most recent significant flood event at the Port of Immingham occurred in 2013 when a storm surge event flooded the Port of Immingham. The Site did not flood during this event, however, should a tidal breach flood event occur during the construction period the baseline flood risk assessment indicates that the Site and surrounding areas could flood to a maximum water level of 5.6m AOD.

18.8.31 The probability of a surge event, overtopping or a breach of the flood defences with a localised or regional effect is low, however, should an event occur it is considered, given the extent and depth of flooding along the South Humber Bank, , that the construction works at the Site would increase the risk of flooding off- site or increase the hazard mapping classification (currently Danger to Some to Danger to Most), to surrounding development as these areas are likely to be flooded to a similar depth as the Site. Given the extensive nature of the residual tidal flood risk extent, any increase in flood water level is likely to be insignificant, therefore the magnitude of change is considered negligible when compared to the current baseline.

18.8.32 In the absence of mitigation, floodplain inundation from tidal flooding has been assessed to have a **minor adverse** effect on the existing development on-site, during the Project's construction phase and a **minor adverse** effect on the existing off-site receptors (based on the highest importance receptor – essential infrastructure (very high importance)), during the Project's construction phase.

18.8.33 Proposed mitigation measures would include designating storage areas for construction materials and ensuring they are stored in line with best practice. Best practice measures to achieve this would be specified by the contractor in the final CEMP. The establishment of the Temporary Construction Compounds would require a Flood Risk Activity Permit, obtained under protective provisions from the Environment Agency as part of the DCO. This would require an additional FRA for the compound areas as part of the permit application.

18.8.34 Mitigation also includes signing up to the Environment Agency Flood Warning Service, and the production of a Flood Emergency Response Plan. When extreme weather results in a flood warning being in place, construction plant would be removed from the Site for the duration of the warning and construction work would cease.

18.8.35 On the landward side of the development, temporary works and contingency measures will be put in place, as necessary, for the construction of the proposed access ramps and new section of flood defence to ensure the existing flood defence is available as required. During construction on the seaward side of the defences, piling activities will be located a sufficient distance away from the flood defence and designed so the defence is not adversely affected.

18.8.36 In addition, measures will also include a combination of detailed weather forecasting with works only undertaken at low tide and use of temporary barriers. The contractor will be required to have a contingency plan in place, for the deployment of flood protection measures within a timescale agreed with the Environment Agency. These are described further in the FRA (**Appendix 18.A [TR030008/APP/6.4**]) and above in **Section 18.7.**

18.8.37 Following implementation of mitigation measures, the residual effect would remain a **minor adverse** effect for development both on-site and off-site, and therefore not significant.

Changes to flow regimes and/or water levels

18.8.38 The fluvial and surface water baseline flood risk could be exacerbated during the construction phase from an increase in impermeable areas such as compacted soils, and the presence of stockpiled materials and equipment temporarily stored on the floodplain. In addition, changes in existing flood flow routes due to the presence of stockpiles and equipment also has the potential to exacerbate the risk of flooding from fluvial, surface water sources.

18.8.39 The construction phase of the Project would involve works close to the North Beck Drain (**Work No.9** only), Habrough Marsh Drain (East Site), Immingham Pump Drain (West Site), plus small land drainage ditches within and in close proximity to the Site.

18.8.40 In addition, within **Work No. 2**, where the jetty access road crosses the existing land drainage ditch, up to three new culverted sections are proposed. Works in the channel associated with installation of the culverts during the construction phase have the potential to restrict flow causing water levels to increase in the channel upstream and could also temporarily reduce the capacity of the channel. Elsewhere within **Work No. 2**, the existing land drainage ditch will be cleared of vegetation, re-lined and have a grated cover installed to allow access for maintenance of the pipe rack. Grating ensures the open nature of the watercourse is retained. The available flow area of the channel will be maintained and even improved by the removal of vegetation.

18.8.41 In the absence of mitigation, the baseline fluvial flood risk could be exacerbated during construction works by the short term, temporary increases in the rate and volume of surface water runoff from an increase in impermeable areas such as compacted soils and the presence of stockpiled materials and equipment temporarily stored on the floodplain. Sediment, construction materials and equipment may also be washed downstream where it may block the channel and lead to or increase the risk of fluvial flooding during the construction phase.

18.8.42 Given the potential for fluvial flood risk to increase from North Beck Drain, Habrough Marsh Drain, Immingham Pump Drain (receptors of high importance), and the local land drains (receptors of medium importance) the magnitude of change during the construction phase is considered to be moderate adverse, therefore the significance of effect is assessed, in the absence of mitigation, **moderate adverse** and therefore significant.

18.8.43 However, with the implementation of standard construction methods and mitigation, as described **Section 18.7**, the short-term temporary increase in water level can be effectively managed for example by monitoring weather forecasts and Environment Agency flood warnings, by undertaking works close to or within watercourses during periods of dry weather. The contractor will ensure an adequate temporary drainage system is in place and maintained throughout the construction phase.

18.8.44 The design approach to sizing of the new culverts is to match or exceed the existing cross section of the relevant land drain. The final design of the culverts will be undertaken in consultation with NELIDB and confirmed through protective provisions via the DCO. The final designs will ensure that there is no decrease in channel capacity or conveyance along the drains to prevent any obstruction to flow within the channel, therefore flows up and downstream of the proposed culvert locations would not be adversely affected. Removal of vegetation from the channels of the land drains where works will occur will also improve storage capacity within the watercourses.

18.8.45 With mitigation in place, the magnitude of change for short term, temporary increases in water levels and changes to flow regimes during the construction phase is considered to be negligible compared to the current baseline. This results in a **minor adverse** effect for North Beck Drain, Habrough Marsh Drain and Immingham Pump Drain and a **negligible** effect for the local land drains, not significant.

Changes to surface water runoff rates and volumes

18.8.46 The Site is classed as a mixture of brownfield land (i.e. previously developed) and greenfield land (i.e. undeveloped land) and comprises predominantly of permeable surfacing, including areas of vegetation and areas of compacted ground which were previously used for stockpile storage or were previously paved.

18.8.47 The Site is in general considered to be at very low risk from surface water flooding, although in some areas associated with watercourse corridors and low topographic areas there are areas of low, medium and high risk as outlined in the baseline conditions and the FRA (**Appendix 18.A [TR030008/APP/6.4]**).

18.8.48 During the construction works, existing surface water flow paths may be disrupted and altered due to site clearance, earthworks, and excavation work. The exposure and compaction of bare ground and the construction of new embankments, structures, and impermeable surfaces may increase the rates and volume of runoff and increase the risk from surface water flooding.

18.8.49 A temporary increase in surface water runoff and changes in existing surface water flow paths has the potential to temporarily exacerbate the risk of flooding from fluvial sources via temporary uncontrolled discharges to North Beck Drain (adjacent to Works No. 9), Habrough Marsh Drain, Immingham Pump Drain and the local land drains within and adjacent to the Site Boundary.

18.8.50 The Site drains predominantly to the south to North Beck Drain either via local field drains or via the Immingham Pump Drain. Drainage to the north to Habrough Marsh Drain from the Site is limited to the areas in close proximity to the watercourse.

18.8.51 Given the potential for increased surface water run-off during the construction phase increasing the risk of fluvial flooding from North Beck Drain, Habrough Marsh Drain, Immingham Pump Drain (receptors of high importance), and the local land drains (receptors of medium importance) the magnitude of change during the construction phase is considered to be moderate adverse, therefore the significance of effect is assessed, in the absence of mitigation, **moderate adverse** and therefore significant.

18.8.52 Temporary drainage facilities would be provided by the contractor during the construction phase, where necessary, to ensure controlled discharge of surface water run-off. Temporary management of surface water runoff together with the implementation of best practice construction methods (see **Section 18.7**), means this risk can be effectively managed. As such, the magnitude of change for surface water flooding is considered to be negligible resulting in a **minor adverse** effect for North Beck Drain, Habrough Marsh Drain and Immingham Pump Drain and a **negligible** effect for the local land drains, not significant.

Changes to tidal regime

18.8.53 Dredging associated with the marine element of the Project would change seabed levels and has the potential to change wave heights, tidal water levels and the rates of erosion or accretion on the foreshore in proximity to the flood defences during the construction phase.

18.8.54 Construction of new infrastructure in the Humber near to the gravity outfall of Habrough Marsh Drain has the potential to increase accretion rates which could result in siltation which would impede the discharge from the watercourse across the intertidal area.

18.8.55 Impacts from the Project on the tidal hydrodynamic regime are discussed in detail in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.

18.8.56 During the construction phase Physical Processes assessment (in **Chapter 16: Physical Processes [TR030008/APP/6.2]**) concludes that overall, the increase in suspended sediment concentration ("SSC") and potential sedimentation in the marine environment is likely to be the same as that which already occurs from existing maintenance dredging in the area (which has been occurring for many years). Moreover, peak increases will remain within the envelope of natural variability in background SSC. In addition, it is considered unlikely that there would be any notable impact on local flows across the adjacent intertidal area and, by association, no likely impact on local accretion or erosion processes.

18.8.57 Given the spatial extent of the physical processes acting within the Humber Estuary, there is considered to be a negligible change in the magnitude of any local changes in tidal regime as a result of the Project. Therefore, the significance of effect on the flood defences (very high importance) is considered to be a **minor adverse** effect and not significant. The significance of effect on the Habrough Marsh Drain (high importance), in terms of accretion/erosion rates impacting the drainage across the intertidal area is considered a **minor adverse** effect and not significant.

Exposure to Flood Water

18.8.58 The Site is situated in Flood Zone 3a. However, it is protected by flood defences, and the baseline assessment suggests a low risk of flooding from all sources, with the exception of groundwater flooding which is assessed as a medium risk.

18.8.59 The location of the Site (immediately adjacent to the Humber Estuary and directly behind flood defences) presents a risk to site workers and visitors to the Site during the construction phase from predominantly tidal sources. Should a storm surge, overtopping or breach of the flood defences occur exposure of construction workers/ site visitors to floodwater includes risk of drowning, risk of injury, risk of swallowing contaminated water and risk of hyperthermia.

18.8.60 Overtopping or a breach of flood defences would represent a significant to extreme hazard at the site, however, the likelihood of an overtopping or breach event occurring is low.

18.8.61 The Project would include the installation of a surface water and foul drainage network and the Laporte Road culvert (an underground culvert, containing pipelines and cables and other conducting media, under Laporte Road, to link infrastructure in the East Site). No significant below ground structures are proposed.

18.8.62 Based on the observed groundwater levels at the Site, excavation of cuttings and below ground excavations have the potential to release groundwater in some areas, and open excavations in some locations may also be more prone to becoming inundated by groundwater. The risk of injury and contact with contaminated water is also associated with exposure to groundwater and flooding from other sources, should they occur.

18.8.63 As receptors, site workers are considered as being of high importance (site workers with prior knowledge of the risks of flooding and what to do in the event of a flood as part of their site induction, as defined in **Table 18-11**Table 18-2 whilst site visitors who are less aware of possible flood risks, as defined in **Table 18-11**Table 18-2, are considered to be receptors of very high importance.

18.8.64 With no mitigation in place, should a tidal breach or overtopping flood event occur during the construction phase exposure to floodwater, would have a major impact on human health (construction workers and operatives, site visitors) and therefore a significance of effect of **large adverse** (site workers) and **very large adverse** (site visitors), a significant effect during the construction phase of the Project.

18.8.65 Should flooding from other sources (fluvial, groundwater, surface water and drainage) occur during the construction phase, exposure to floodwater would have a minor impact on human health (construction workers and operatives, site visitors) and therefore a significance of effect of **minor adverse** (site workers) not significant, and **moderate adverse** (site visitors), a significant effect.

18.8.66 Proposed mitigation measures that would reduce this effect include construction works would be carried out in accordance with the **Outline CEMP [TR030008/APP/6.5]**, including the Flood Emergency Response Plan. A site induction would be given, including outlining evacuation routes, safe refuge, access and egress areas prior to works commencing. The construction site would be registered with the Environment Agency Flood Warnings Direct Service. There will also be no work taking place on site during periods of extreme weather when a flood warning is received from the Environment Agency.

18.8.67 Following implementation of these mitigation measures, the impact would be reduced to negligible and the residual effect of exposure to floodwater from all sources of flooding on human receptors would be **minor adverse** and not significant.

Operational Impacts and Effects

18.8.68 A qualitative assessment of the likely significant effects on surface water quality and flood risk receptors during the operational phase of the Project is presented in the following paragraphs:

Water Quality impacts to North Beck, Habrough Marsh Drain and Local Drains

18.8.69 There are several impact pathways that have been assessed to have a potential impact on the North Beck Drain, Habrough Marsh drain and local drains as a result of the operational phase of the Project. These are as follows and are discussed in the following paragraphs:

a. Potential operational pollution of surface watercourses from accidental spillages.

b. Potential run off of hazardous fire-fighting chemicals to surface watercourses.

18.8.70 The North Beck Drain, Habrough Marsh drain and local drains could be impacted by potential operational pollution of surface watercourses as a result of accidental spillages (e.g. infrastructure breakages or vehicle accidents, should they occur. The effect is assessed to be minor to moderate adverse, however mitigation measures are proposed which would be to implement containment areas and to employ bunded operations, as well as mandating the use of spill kits on site. With this proposed mitigation in place, the residual effect would be **negligible/minor averse**, which is not significant.

18.8.71 The potential for run off of hazardous firefighting chemicals to surface watercourses would impact the North Beck Drain, Habrough Marsh drain and local drains during operation of the Project and has been assessed to have a major adverse impact. Mitigation would take place in the form of designated containment areas including a bunded operational area as well as the use of spill kits and the treatment/removal of liquids. With these measures in place, the residual effect would be **negligible/minor adverse** and not significant.

Water Quality impacts to Coastal and Floodplain Grazing Marsh and good Quality Semi-improved Grassland

18.8.72 Potential operational pollution of surface water courses from accidental spillages would impact Coastal and Floodplain Grazing Marsh and good quality semi-improved grassland during operation of the Project. This effect would be negligible / minor adverse. Containment measures and bunded operations, as well as the use of spill kits on site would be implemented to mitigate this effect and as a result, the residual effect would be **negligible** and not significant**.**

Floodplain inundation from flooding sources

18.8.73 With rainfall intensity, peak water levels, sea water level and wave heights set to increase, as a consequence of climate change, over the operation of the Project lifetime, the likelihood of flooding occurring to the Project and the surrounding areas from all sources will increase compared to the current baseline. This potential increase in flood risk could result in damage to the development and disruption of site operations. In addition, the presence of newly built structures located on the Site has the potential to change flood flow routes and increase the risk of flooding to neighbouring sites through displacement of flood water.

18.8.74 In line with Shoreline Management Plan ("SMP") (Ref 18-39) and Humber Flood Risk Management Plan ("FRMP") (Ref 18-35) 'Hold the Line' management policy it is assumed that the crest height of the Environment Agency flood defences will be raised to maintain the 0.5% AEP standard of protection afforded by the flood defences over the operation of the development. Flood defences will have been raised locally (in proximity to the jetty access ramp/pipe rack) during the construction phase. However, the residual risk of flooding from overtopping and breach events will remain. By the year 2115, should a breach event occur, the Site and the surrounding areas will be located in a 'Danger to All' hazard area and flooded to a depth of 6m AOD during a 0.1% AEP breach event.

18.8.75 It is possible that the Project could have an impact on tidal flooding during a breach or overtopping event due to an alteration of flood mechanism and flows due to land raising. As part of the Drainage Strategy (appended at Appendix 18.B **[TR030008/APP/6.4]**) design ground levels within the East Site (would be raised during construction by 0.3m (**Work No. 5**) and 0.6m (**Work No. 3**) respectively, giving finished ground levels of approximately 3.8m AOD and 3.6m AOD. In addition, the West Site (**Work No. 7**) would be raised to a final ground level of approximately 2.5m AOD.

18.8.76 The proposed ground levels are located below the breach flood water levels for both the 0.5% AEP and 0.1% AEP 2115 flood events, approximately 5.9m AOD and 6m AOD respectively, and therefore floodplain storage would be lost which could potentially increase the risk of tidal flooding off site.

18.8.77 The Site is considered to be at low risk of flooding from all other sources with the exception of groundwater flooding which is assessed as a medium risk. Flooding from these sources, although considered to be temporarily disruptive on site should flooding occur, are not considered significant when compared to the impact of a tidal flood event.

18.8.78 The landside development within the defined Site Boundary during the operation phase comprises "essential infrastructure" (assessed as a receptor of very high importance) whilst the marine side development comprises development classed as "water compatible" (assessed in **Table 18-3** as a receptor of "low importance").

18.8.79 Existing development on neighbouring sites comprises mixed use development, including commercial, residential, industrial/warehouse uses, and tanked bulk storage uses with hazardous substance consents etc., assessed as receptors of low importance to very high importance (based on the PPG (Ref 18-14) development vulnerability classifications outlined in **Table 18-11**).

18.8.80 Compensatory storage for the loss of floodplain behind tidal flood defences is not required given the residual risk and the extensive nature of flooding should overtopping or a breach of the flood defences occur. It is unlikely, given the extent and depth of flooding along the South Humber Bank should a breach occur, that the Project would increase the risk of flooding off- site to surrounding land as these areas are likely to be flooded to a similar depth as the Site. Both the Site and the surrounding area are predominantly located in the hazard category 'Danger for All' and this is unlikely to change with the Project in-situ. Given the extensive nature of the residual tidal flood risk extent, any increase in flood water level is likely to be insignificant, therefore the magnitude of change is considered negligible.

18.8.81 In the absence of mitigation, floodplain inundation from tidal flooding has been assessed to have a **minor adverse** effect on the development on-site, during the Project's operation phase and a **minor adverse** effect on the existing off-site receptors (based on the highest importance receptors – essential infrastructure (very high importance)), during the Project's operational lifetime.

18.8.82 Appropriate mitigation measures are therefore required to be implemented at the Site to mitigate this risk. Mitigation embedded in the development design (**See Section 18.7**), site operation and shutdown procedures, elevating critical plant equipment above the breach flood water level, and Flood Emergency Response Plans allow the development to remain safe should a flood event occur. These are described further in the FRA (**Appendix 18.A [TR030008/APP/6.4]**) and above in **Section 18.7**.

18.8.83 Following implementation of mitigation measures, the residual effect would remain a **minor adverse** effect for development both on-site and off-site, and therefore not significant.

Changes to flow regimes and/or water levels

18.8.84 As a consequence of climate change an increase in rainfall intensity will increase surface water runoff rates and volumes from impermeable surfaces on site. There is a potential for an increased risk of flooding from fluvial, surface water sources if provision for surface water management is not put in place. In addition, changes in existing flood flow routes due to the presence of the built development also has the potential to exacerbate the risk of flooding from fluvial and surface water sources.

18.8.85 Mapping of fluvial flood extents presented in the NELC PFRA (Ref 18-36) indicates that for flood risk from fluvial sources the Site is located in Flood Zone 1 and therefore at 'low' risk of fluvial flooding. Modelled water levels for North Beck Drain provided by the Environment Agency (See **Section 18.5**) indicate that flood water levels for the 0.5% AEP plus climate change flood event stay within the channel and does not impact the Site.

18.8.86 RoFSW mapping used as a proxy for flood risk from ordinary watercourses shows that the risk of flooding from Habrough Marsh Drain, Immingham Pump Drain and the land drainage system is also low, however the Site is at residual risk of flooding should the local watercourses become tide-locked for an extended period of time.

18.8.87 As part of the Drainage Strategy (appended at **Appendix 18.B [TR030008/APP/6.4]**) design ground levels within the East Site (would be raised during construction by 0.3m (**Work No. 5**) and 0.6m (**Work No. 3**) respectively, giving finished ground levels of approximately 3.8m AOD and 3.6m AOD. In addition, the West Site (**Work No. 7)** would be raised by approximately 1 m, giving a final ground level of approximately 2.5m AOD. During a future flooding scenario resulting from climate change the Site would remain at 'low' risk of fluvial flooding.

18.8.88 As the Site is located within Flood Zone 1 and the areas where ground raising is proposed in the East and West Sites are not at risk of flooding from fluvial sources, the Project would not result in a loss of fluvial floodplain storage. There is also limited potential for alterations to fluvial flood mechanisms and fluvial flood flow routes both on and off-site.

18.8.89 With the absence of mitigation, given the potential for fluvial flood risk to increase from North Beck Drain, Habrough Marsh Drain, Immingham Pump Drain (receptors of high importance), and the local land drains (receptors of medium importance) the magnitude of change is considered to be moderate adverse, therefore the significance of effect is assessed, in the absence of mitigation, as **moderate adverse** and therefore significant.

18.8.90 The Project would include a surface water drainage network able to accommodate up to and including the 1% AEP plus 40% climate change event with no surface water flooding. A combination of permeable gravel beds and retention basins would be used on the East and West Sites to manage surface water runoff. Retention basins would provide temporary attenuation before flows are restricted to 70% of the existing discharge rates for all storm events from the East Site and greenfield runoff rates from the West Site (as agreed with the NELIDB) and discharged to the surrounding land drains via new discharge outfalls. The West Site drains to the Immingham Pump Drain via the drainage ditch to the south and the East Site drains via two separate discharges, one to a drain that flows south to North Beck Drain and the second to the drainage ditch to the east that ultimately discharges into North Beck Drain. Permeable gravel beds would provide an element of attenuation storage in addition to suitable water quality management for areas at low risk of contamination Areas at high risk of contamination are located within bunded areas within the Site. Further details of the proposed approach can be found in **Appendix 18.B Drainage Strategy (TR030008/APP/6.4]).**

18.8.91 With mitigation in place the magnitude of change is considered to be negligible resulting in a **minor beneficial** effect which is not significant.

Changes to surface water runoff rates and volumes

18.8.92 Impermeable surfacing across the Site would increase as a consequence of the Project therefore it is likely that the rates of surface water run-off would increase above those of the baseline scenario.

18.8.93 An increase in rainfall intensity by 40%, in line with Environment Agency climate change guidance (Ref 18-34) would occur over the operation of the Project (assessed to be 75 years). As a consequence of climate change surface water runoff rates and volumes from impermeable surfaces on site would increase with potential for the increased risk of flooding from fluvial, surface water and drainage infrastructure sources if provision for surface water management is not put in place.

18.8.94 Given the potential for increased surface water run-off over the operational lifetime of the Project and the potential for increased fluvial flood risk from Habrough Marsh Drain, Immingham Pump Drain (receptors of high importance), and the local land drains (receptors of medium importance) the magnitude of change is considered to be moderate, therefore significance of effect is assessed, in the absence of mitigation, to be **moderate adverse** and therefore significant.

18.1.2 However, a **Drainage Strategy** (**Appendix 18.B [TR030008/APP/6.4]**). has been prepared for the Project which includes the use of SuDS, site discharge rates restricted to 70% of the existing run-off rate from the East Site and greenfield runoff rates from the West Site, and surface water management/ exceedance flows. A combination of permeable gravel beds and retention basins would be used on the East and West Sites to manage surface water runoff up to and including the 1% AEP plus 40% climate change event.

18.8.95 The West Site drains to the Immingham Pump Drain via the drainage ditch to the south and the East Site drains via two separate discharges, one to a drain that flows south to North Beck Drain and the second to the drainage ditch to the east that ultimately discharges into North Beck Drain. The implementation of this strategy would result in surface water from the Project being carefully managed, treated, and directed to the land drainage ditches at controlled rates.

18.8.96 Given the management of surface water runoff from the development there would likely be a reduction in the surface water run-off to the surrounding watercourses and land drainage ditches and therefore fluvial flood risk in comparison to existing conditions. It is therefore considered that the Project would have a minor beneficial magnitude of change, resulting in a **minor beneficial** effect which is not significant.

Changes in Tidal Regime

18.8.97 The marine development and associated maintenance dredging would change seabed levels and, in addition to the predicted increases in wave height and peak water levels associated with climate change, has the potential to change the rates of erosion and/ or accretion on the foreshore in proximity to the flood defences over the operation of the Project.

18.8.98 Impacts relating to the marine development and changes to the tidal regime for the operational phase are discussed in detail within **Chapter 16: Physical Processes [TR030008/APP/6.2].**

18.8.99 There is potential for the current hydrodynamic processes to change over the operation of the Project. It is possible that flow speeds and wave heights may decrease in the area between the berth pocket and the Project frontage as well as along the wider Port of Immingham frontage. Any change is, however, predicted to be negligible and unlikely to affect the integrity of the flood defences in these areas. It is unlikely that changes to tidal water levels and the rates of erosion or accretion on the foreshore (above natural variations) both on-site (along the frontage of the Project) and off-site (along the frontage of the wider Port of Immingham) would increase above that which would currently occur when climate change is taken into account.

18.8.100 Mitigation measures are outlined in **Chapter 16: Physical Processes [TR030008/APP/6.2]** and no mitigation measures specific to flood risk are required.

18.8.101 The magnitude of change for changes in tidal regime is considered to be negligible and therefore the significance of effect for the flood defences (very high importance) is considered to be a minor adverse effect and not significant. The significance of effect on the Habrough Marsh Drain (high importance), in terms of accretion/erosion rates impacting the drainage across the intertidal area is considered a minor adverse effect and not significant.

Exposure to floodwater

18.8.102 Given the location of the Project the risk of human receptors being exposed to flood water over the operation of the development remains. As with the construction phase, overtopping or a breach of the flood defences would represent a significant to extreme hazard at the Site during the operation phase, however, the likelihood of an overtopping or breach event occurring remains low. Should a breach or overtopping event occur the depth of tidal flooding, flood water velocity and flood hazard will increase both on the Site and across the surrounding area.

18.8.103 As receptors, site workers are considered as being of high importance (site workers with prior knowledge of the risks of flooding and what to do in the event of a flood as part of their site induction), as defined in **Table 18-11**, whilst site visitors (who are less aware of possible flood risks), as defined in **Table 18-11**, are considered to be receptors of very high importance.

18.8.104 The probability of a surge event, overtopping or a breach of the flood defences with a localised or regional effect is low, but the magnitude of change is considered to be a major impact on human health (site operatives, site visitors) and therefore a significance of effect of **large adverse** (site workers) and **very large adverse** (site visitors), a significant effect during the operational phase of the Project.

18.8.105 Proposed mitigation measures that would reduce this effect would include the development of a Flood Response Plan which would be adhered to. A site induction would also be given to all site operatives and workforce, including outlining evacuation routes, safe refuge, and access and egress areas. The operational Site would be registered with the Environment Agency Flood Warnings Direct Service. There will also be full closure of the Site and therefore no operatives/site visitors on site for the duration of a flood warning period.

18.8.106 Following implementation of these mitigation measures the impact would be reduced to negligible and the residual effect of exposure to floodwater on human receptors would be **minor adverse** and **not significant**.

Decommissioning

18.8.107 A qualitative assessment of the likely significant effects on surface water quality and flood risk receptors during decommissioning of the landside infrastructure has been undertaken. With the implementation of standard mitigation measures, which would mirror those that would be implemented during the construction phase and would be contained in the **Outline DEMP [TR030008/APP/6.6],** effects on the water environment are expected to be similar to the construction phase, with the exception of changes to tidal regime effects on flood defences and Habrough Marsh Drain which would remain similar to the operational phase, and would not be significant. Similarly, significant flood risk effects are not anticipated as standard flood risk mitigation measures would be effectively implemented.

18.9 Additional Mitigation

18.9.1 No significant adverse effects are predicted in **Section 18.8** and there is no need to apply additional mitigation to reduce the effects.

18.10 Residual Effects

18.10.1 Given that no additional mitigation is applied, the residual effects remain the same as reported in **Section 18.8**, in each case.

18.11 Summary of Assessment

18.11.1 **Table 18-12** provides a summary of the likely significant effects of the Project on water quality, coastal protection, flood risk and drainage assets, taking into account the embedded mitigation measures detailed in **Section 18.7**. The table confirms that the residual effects would be negligible or minor adverse and would be not significant.

Table 18-12: Summary of Impacts, Mitigation Measures and Residual Effects during the Construction Phase

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
North Beck, Habrough Marsh drain and local drains (Water quality/ Water flow – Medium)	Direct spillage: Contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into waterbodies when there are works within or adjacent to them.	Moderate/Major adverse	Bunded operations and spill kits to be used on Site (As specified in Table 3.16 of the **outline CEMP [TR030008/APP/6.5]).**	Negligible/Minor adverse (Not Significant)	High
	Runoff contamination: The effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).	Minor/Moderate adverse	Bunded operations for all chemicals and fuels needed on Site (to be specified in the CEMP).	Negligible/Minor adverse (Not Significant)	High
	Alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain	Minor/Moderate adverse	Areas for storage of construction materials to be carefully considered (to be specified in the CEMP).	Negligible/Minor adverse (Not Significant)	High
	Increased risk of blockage of drains as a result of increased material (sands, gravels etc.) transported in runoff from Site.	Minor/Moderate adverse	Surface water runoff to be managed on site (to be specified in CEMP).	Negligible/Minor adverse (Not Significant)	High
Coastal and floodplain grazing marsh and good quality semi-improved grassland **(Water quality – Low)**	Direct spillage: Contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into non-priority habitat when there are works within or adjacent to them.	Negligible/Minor adverse	Bunded operations and spill kits to be used on Site (to be specified in the CEMP).	Negligible (Not Significant)	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
	Runoff contamination: The effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).	Negligible/Minor adverse	Bunded operations for all chemicals and fuels needed on Site (to be specified in the CEMP).	Negligible (Not Significant)	High
Existing Development on-site **(Very High)**	Floodplain inundation from tidal flooding due to a breach/overtopping event, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain	Minor adverse	Areas for storage of construction materials to be carefully considered (to be specified in the CEMP). Flood resilience and resistant measures embedded in design. Overland flow paths maintained and temporary drainage to control surface water discharge.	Minor adverse (Not Significant)	High
Existing Development off-site **(Very High)**	Floodplain inundation from tidal flooding due to a breach/overtopping event, alteration in fluvial and overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of storing construction materials in the floodplain	Minor adverse	Areas for storage of construction materials to be carefully considered (to be specified in the CEMP). Overland flow paths maintained and temporary drainage to control surface water discharge.	Minor adverse (Not Significant)	High
North Beck Drain (High)	Increase in risk of fluvial/surface water flooding due to changes in surface water	Moderate Adverse	Temporary drainage facilities (swales etc)	Minor Adverse (Not Significant)	High

Receptor (Importance)		Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
Surface Waterbodies	**Habrough Marsh Drain (High)**	runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses.		provided during the construction phase to control discharge of surface water run-off.		
	Imminhgam Pump Drain (High)					
	Local land drainage ditches (Medium)				Negligible (Not Significant)	
Flood Defences **(Very High)**		Potential changes in tidal regime including wave height, water velocities and erosion/accretion rates.	Minor Adverse	None required beyond those outlined in **Chapter 16: Physical Processes [TR030008/APP/6.2]** and the ongoing inspection and maintenance programme undertaken by the Environment Agency.	Minor Adverse (Not Significant)	High
Habrough Marsh Drain (High)		Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk	Minor Adverse	None required beyond those outlined in **Chapter 16: Physical Processes [TR030008/APP/6.2].**	Minor Adverse (Not Significant)	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
Human Health **Construction workers and operatives (High)**	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	Large adverse.	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site will be registered with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather. No work onsite during a flood warning period	Minor Adverse (Not Significant)	High
Human Health **Site Visitors (Very High)**		Very Large Adverse		Minor Adverse (Not Significant)	High

Table 18-13: Summary of Impacts, Mitigation Measures and Residual Effects during the Operational Phase

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
North Beck, Habrough Marsh drain and local drains (Water quality/ Water flow – Medium)	Potential operational pollution of surface watercourses from accidental spillages.	Minor/Moderate adverse	Containment areas and Bunded operations and spill kits to be used on Site.	Negligible/Minor adverse (Not Significant)	High
	Potential run off of hazardous firefighting	Major adverse	Containment areas and Bunded operational area	Negligible/Minor adverse	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
	chemicals to surface water course		with spill kits to be used and treatment/removal of liquids	(Not Significant)	
Coastal and floodplain grazing marsh and good quality semi-improved grassland **(Water quality – Low)**	Potential operational pollution of surface watercourses from accidental spillages.	Negligible/ Minor adverse	Containment areas and Bunded operations and spill kits to be used on Site.	Negligible (Not Significant)	High
Existing Development on-site **(Very High)**	Floodplain inundation from tidal flooding due to a breach/overtopping event, alteration in fluvial and overland flow paths, and potential increase in flood risk	Minor adverse	Embedded mitigation in the development design site operation and shutdown procedures, elevating critical plant equipment above the breach flood water level, and Flood Emergency Response Plans allow the development to remain safe should a flood event occur. Provision of a drainage strategy to manage surface water run-off and retain surface water within the Project boundary.	Minor adverse (Not Significant)	High

Receptor (Importance)		Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
Existing Development off-site **(Very High)**		Floodplain inundation from tidal flooding, alteration in tidal and fluvial overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of land raising in the West and East Sites.	Minor adverse	Site/surrounding area registered with the Environment Agency Flood Warnings Direct Service. Provision of a drainage strategy to manage surface water run-off up to and including the 1% AEP plus 40% climate change allowance. Surface water is stored and retained within the Project boundary.	Minor adverse (Not Significant)	High
Surface Waterbodies	**North Beck Drain (High)**	Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths,	Moderate adverse	Site/surrounding area registered with the Environment Agency Flood Warnings Direct Service. Provision of a drainage strategy to manage surface water run-off up to and including the 1% AEP plus 40% climate change allowance. Surface water is stored and retained within the Project boundary.	Minor beneficial (Not Significant)	High
	Habrough Marsh Drain (High)					
	Immingham Pump Drain (High)					

Receptor (Importance)		Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
	Local land drainage ditches (Medium)					
	North Beck Drain (High)	Increase in risk of surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths,	Moderate adverse	Provision of a drainage strategy to manage surface water run-off up to and including the 1% AEP plus 40% climate change allowance. Surface water is stored and retained within the Project boundary.	Minor beneficial (Not Significant)	High
	Habrough Marsh Drain (High)					
	Immingham Pump Drain (High)					
	Local land drainage ditches (Medium)					
Flood Defences (Very High)		Potential changes in tidal regime including wave height, water velocities and erosion/accretion rates	Minor Adverse	None Required	Minor adverse (Not Significant)	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
Habrough Marsh Drain (High)	Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk	Minor Adverse	None required beyond those outlined in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.	Minor adverse (Not Significant)	High
Human Health **Site operatives and future workforce**	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	Large adverse.	Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site registered with the Environment Agency Flood Warnings Direct Service. No work or visitors onsite during a flood warning period.	Minor adverse (Not Significant)	High
Human Health **Site Visitors (Very High)**	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	Very Large adverse.	Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site registered with the Environment Agency Flood Warnings Direct Service. No work or visitors onsite during a flood warning period.	Minor adverse (Not Significant)	High

Table 18-14: Summary of Potential Impacts, Mitigation Measures and Residual Effects during Decommissioning

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
North Beck, Habrough Marsh drain and local drains **(Water quality/ Water flow – Medium)**	Direct spillage: Contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into waterbodies when there are works within or adjacent to them.	Moderate/Major adverse	Bunded operations and spill kits to be used on Site (to be specified in the DEMP).	Negligible/Minor adverse (Not Significant)	High
	Runoff contamination: The effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).	Minor/Moderate adverse	Bunded operations for all chemicals and fuels needed on Site (to be specified in the DEMP).	Negligible/Minor adverse (Not Significant)	High
Coastal and floodplain grazing marsh and good quality semi-improved grassland **(Water quality – Low)**	Direct spillage: Contamination from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into non-priority habitat when there are works within or adjacent to them.	Negligible/Minor adverse	Bunded operations and spill kits to be used on Site (to be specified in the DEMP).	Negligible (Not Significant)	High
	Runoff contamination: The effects of diffuse urban pollutants in surface water	Negligible/Minor adverse	Bunded operations and spill kits to be used on Site (to be	Negligible (Not Significant)	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
	runoff (that may contain metals, hydrocarbons, and inert solids etc.).		specified in the DEMP).		
Existing Development on-site **(Very High)**	Floodplain inundation from tidal flooding due to a breach/overtopping event, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing materials in the floodplain	Minor adverse	Areas for storage of materials to be carefully considered (to be specified in the DEMP). Overland flow paths maintained and surface water drainage system to remain in-situ.	Minor adverse (Not Significant)	High
Existing Development off-site **(Very High)**	Floodplain inundation from tidal flooding due to a breach/overtopping event, alteration in fluvial and overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of storing materials in the floodplain	Minor adverse	Areas for storage of materials to be carefully considered (to be specified in the DEMP). Overland flow paths maintained and surface water drainage system to remain in-situ.	Minor adverse (Not Significant)	High
Surface Waterbodies:		Moderate Adverse		Minor adverse (Not Significant	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
North Beck Drain (High)	Increase in risk of fluvial/surface water flooding due disruption/alteration of existing surface water flow paths, works/structures within watercourses.		Overland flow paths maintained and surface water drainage system to remain in-situ.		
Habrough Marsh Drain (High)					
Immingham Pump Drain (High)					
Local land drainage ditches (Medium)				Negligible (Not Significant)	
Flood Defences **(Very High)**	Potential changes in tidal regime including wave height, water velocities and erosion/accretion rates.	Minor Adverse	None required beyond the ongoing inspection and maintenance programme undertaken by the Environment Agency	Minor adverse (Not significant)	High
Habrough Marsh Drain (High)	Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk	Minor Adverse	None required beyond those outlined in **Chapter 16: Physical Processes [TR030008/APP/6.2]**.	Minor adverse (Not Significant)	High

Receptor (Importance)	Impact Pathway	Effect (Unmitigated)	Mitigation Measure	Effect/Residual Effect	Confidence
Human Health **Construction workers and operatives (High)**	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	Large adverse.	Construction works would be carried out in accordance with the DEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site will remain registered with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather. No work onsite during a flood warning period	Minor adverse (Not Significant)	High
Human Health **Site Visitors (Very High)**	Exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	Very Large Adverse		Minor adverse (Not Significant)	High

18.12 References

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 19: Climate Change

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 19: Climate Change

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	**Date**	**Status of Version**
Revision 1	21 September 2023	DCO Application

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19. Climate Change

19.1 Introduction

19.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project in relation to climate change.

19.1.2 To align with the requirements of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (Ref 19-1) and Institute of Environmental Management and Assessment ("IEMA") guidance on assessing climate change mitigation (Ref 19-2) and adaptation (Ref 19-3) consideration of climate change effects is covered by the following three aspects:

a. Lifecycle greenhouse gas ("GHG") impact assessment – Impact of GHG emissions arising from the Project on the climate, including how it would affect the ability of the UK government to meet its planned carbon reduction targets (Ref 19-4).

b. Climate change resilience ("CCR") assessment – The resilience of the Project to climate change impacts, including how the design would consider projected impacts of climate change.

c. In-combination climate change impact ("ICCI") assessment – The combined impact of the Project and potential climate change on the receiving environment.

19.1.3 There are interrelationships related to the Project and climate change, along with other disciplines. Therefore, reference should be made to the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 9: Nature Conservation (Marine Ecology).**

b. **Chapter 18: Water Quality, Coastal Protection, Flood Risk and Drainage.**

19.1.4 This chapter is supported by the following appendices **[TR030008/APP/6.4]**:

a. **Appendix 19.A – Greenhouse Gas (GHG) Assessment.**

b. **Appendix 19.B – Climate Change Resilience (CCR) Assessment.**

c. **Appendix 19.C – In-Combination Climate Change Impact (ICCI) Assessment.**

19.2 Consultation and Engagement

19.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the climate change assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria applied in the assessment to identify and evaluate the likely significant effects of the Project on climate change. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 (**Appendix 1.B [TR030008/APP/6.4]**).

19.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). Further information on the consultation is provided within **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

19.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May 2023 and 20 July 2023 in accordance with the 2008 Act and a Preliminary Environmental Information ("PEI") Report Addendum was publicised to support the consultation.

19.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4]**), is summarised in **Table 19-1**. Note that no comments were received in relation to climate change during Statutory Consultation.

Table 19-1: Consultation summary table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes to scope out GHG emissions arising from operational maintenance activities on the grounds that emissions from maintenance works are likely to be minimal in relation to the overall GHG emissions from the Proposed Development. However, the Scoping Report does not provide any supporting evidence for this statement. In the absence of such evidence, and particularly given the uncertainty around dredging requirements, Inspectorate is not in a position to agree to scope these matters from the assessment. Accordingly, the Environmental Statement (ES) should include an assessment of these matters or further justification that the works are likely to give rise to minimal GHG emissions.	Emissions from operational maintenance activities are considered in the GHG assessment. (see **Table 19-20**Table 19-20). Note the GHG assessment has considered the seven Kyoto Protocol gases: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Sulphur hexafluoride (SF_6), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs); and Nitrogen Trifluoride (NF_3).
		The Scoping Report proposes to scope out the impacts of wind from both the climate change resilience (CCR) assessment and the in-combination climate change impact (ICCI) assessment, on the basis that there is no evidence to suggest that climate change is increasing high wind events (referencing the Met Office (2020) State of the UK Climate report). The Inspectorate notes that Environment Agency guidance (2021) Refineries and fuel: examples for your adapting to climate change risk assessment, specifically considers wind stating "*there is risk to: jetties with higher sideways loadings due to wave and wind action*". In light of this guidance and in absence of agreement with the relevant statutory body, the Inspectorate is not in a position to agree to scope this matter from the assessment.	Consideration of mitigation measures against wind events has been addressed in this assessment (see **Section 19.7**).

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The ES should state which emissions scenario will be applied from the UK Climate Projection 2018 (UKCP18) data as this is not currently clear from the Scoping Report. The ES should be based on up-to-date climate projections at the point of submission.	This has been explicitly stated in the assessment (see **Paragraph 19.6.11**).
		The transportation and disposal of waste is listed as source of emissions but dredging and disposal of dredged material is not explicitly included within this. The ES should consider emissions from these activities.	Data to calculate emissions from dredging was not available for the PEI Report assessment. It has been assessed in the GHG assessment discussed in this chapter (see **Section 19.8**).
	Environment Agency	Paragraph 18.3.7 advises that wind change has been ruled out for the climate change resilience review. Environment Agency guidance on climate change adaption for refineries specifically considers wind stating "*there is risk to: jetties with higher sideways loadings due to wave and wind action*". Accordingly, we would suggest it may be relevant to scope in this issue.	Consideration of mitigation measures against wind events has been included in this assessment (see **Section 19.7**).
		The Applicant may also find it useful to refer to government guidance on Adapting to climate change: industry sector examples for your risk assessment – GOV.UK (www.gov.uk), with specific consideration to the guidance for the 'Chemical' and 'refineries and fuel' sectors, as the closest relevant sectors.	This has been reviewed, and any relevant guidance included in this assessment. Additional climate risks and mitigation relevant to this development are included in **Appendix 19.B [TR030008/APP/6.4]**.
		We would also ask that the EIA is clear about which emissions scenario will be used from the UKCP18 data as this is not currently clear from the Scoping Report	This has been explicitly stated in the assessment (see **Paragraph 19.6.11**).

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
PEI Report (Statutory Consultation) January – February 2023	No consultation responses relevant to Climate Change were received.		
Second Statutory Consultation May – July 2023	No consultation responses relevant to Climate Change were received.		

19.3 Legislation, Policy and Guidance

19.3.1 **Table 19-2** presents the legislation, policy and guidance relevant to the climate change assessment and details how their requirements have been met.

Table 19-2: Relevant legislation, policy and guidance regarding climate change

Legislation/Policy/Guidance	Consideration within the ES
United Nations Framework Convention on Climate Change Paris Agreement (Ref 19-5)	
The Framework requires all signatories to strengthen their climate change mitigation efforts to keep global warming to below 2°C this century and to pursue efforts to limit global warming to 1.5°C.	Since its withdrawal from the EU, the UK Government declares its own Nationally Determined Contribution ("NDC") setting out its climate change obligations under the Paris Agreement and the climate change target and budgets set under the Climate Change Act 2008 (Ref 19-6). **Section 19.8** presents an assessment to identify the impact of the Project on the UK meeting its climate change target and five-yearly carbon budgets. In support of this the embedded mitigation measures of the Project are set out in **Sections 19.7.**
Climate Change Act 2008 and **Climate Change Act (2050 Target Amendment) Order 2019** (Ref 19-6)	
The Climate Change Act 2008 was amended in 2019 to revise the existing 80% reduction target and legislate for net zero emissions by 2050 (through the Climate Change Act 2008 (2050 Target Amendment) Order 2019). This target is supported by a system of legally binding five-year 'carbon budgets' and an independent body, the Climate Change Committee (CCC), is to advise on budgets and monitor progress. The UK carbon budgets restrict the amount of GHG emissions the UK can legally emit in a defined five-year period. The 6th Carbon Budget (Ref 19-7) is the first budget to reflect the amended trajectory to net zero by 2050 and came into force in June 2021.	An objective of the Project is to deliver port infrastructure needed to facilitate the future transportation of bulk liquids associated with the energy sector that would support the transition to net zero. The new jetty would further support sustainable development by providing additional capacity for the development of the renewable energy and carbon capture sectors. An assessment of the impact of the Project against the Government's carbon target and budgets is set out in **Section 19.8**. Embedded and good practice mitigation measures have been identified in **Section 19.7**.
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations') (Ref 19-8)	
The EIA Regulations state that an EIA (where relevant): "*must include a description of the likely significant effects of the development on the environment resulting from… the impact of the project on climate (for example the nature and magnitude of*	Likely significant effects as a result of the vulnerability of the Project to climate change, following the inclusion of embedded and good practice mitigation measures, are presented in **Section 19.8**.

Legislation/Policy/Guidance	Consideration within the ES
greenhouse gas emissions) and the vulnerability of the project to climate change".	Likely significant effects on the climate as a result of the Project are assessed in **Section 19.8**.
The National Policy Statement for Ports ("NPSfP") (Ref 19-9)	
Paragraph 4.1.1 of Section 4.1 states "*information sought from applicants should be proportionate to the scale of proposed development and associated impacts, including its likely impact on and vulnerability to climate change, as well as all other aspects of conformity with this NPS*".	The principles and methodology of the climate change assessment presented in this chapter are developed in line with the NPSfP. Impact of GHG emissions arising from the Project on the climate, and the resilience of the Project to climate change impacts are considered and both presented in **Section 19.8**.
Para 4.12 provides guidance on how to consider both climate change mitigation and shipping and inland transport emissions. In its guidance 4.12.2 it states that greenhouse gas emissions from ships are by nature international and therefore not included in national targets	The methodology for this assessment considers shipping emissions as they are included within the sixth carbon budget for the UK and Department for Transport's transport decarbonisation plan. Impacts from shipping are discussed in **Section 19.8**.
Paragraph 4.13.6 of Section 4.13 states that "*…applicants must consider the impacts of climate change when planning the location, design, build and operation of new port infrastructure…. The ES should set out how the proposal will take account of the projected impacts of climate change.*"	The principles and methodology of the climate change assessment presented in this chapter are developed in line with the NPSfP. Impact of GHG emissions arising from the Project on the climate, and the resilience of the Project to climate change impacts are considered and both presented in **Section 19.8**.
Paragraph 4.13.7 of Section 4.14 states that "*Applicants should use the latest set of UK Climate Projections to ensure they have identified appropriate adaptation measures. Applicants should apply, as a minimum, the emissions scenario that the independent Climate Change Committee suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges.*"	The future baseline for both CCR and ICCI assessment is based on the future UK Climate Projection 2018 ("UKCP18") data from the Met Office (Ref 19-19). The latest set of UK Climate projections have been used in accordance with the principles set out in the NPSfP. This is presented in **Section 19.6**.
Paragraph 4.13.8 in Section 4.13 states that "*In addition, where port infrastructure has safety-critical elements (e,g, storage of gas, petro-chemical) the applicant should apply the high emissions scenario (high impact, low likelihood) to those elements critical to the safe operation of the port infrastructure.*"	The GHG Impact Assessment has adopted a worst-case approach for any uncertainty in the design, in line with suggestions in IEMA guidance (Ref 19-2), as presented in **Section 19.4**.
The National Planning Policy Framework ("NPPF") (Ref 19-10)	
The Framework sets out the Government's planning policies for England. While the NPPF does not set specific policies for Nationally Significant	The GHG emissions methodology and assessment described in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) have been developed in line with the NPPF guidance.

Legislation/Policy/Guidance	Consideration within the ES
Infrastructure Projects (NSIPs), its policies may be of relevance to the decision-making process. Policies of relevance to climate change and sustainability assessment include those aimed at achieving sustainable development and meeting the challenge of moving to a low carbon economy, climate change, flooding and coastal change. The NPPF states that the planning system should support this transition by supporting low carbon energy and associated infrastructure.	Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.7**.
National Planning Policy Guidance on Climate Change (Ref 19-11)	
The guidance describes how to identify suitable mitigation and climate adaptation measures to incorporate into the planning process, stating that: "…*effective spatial planning is an important part of a successful response to climate change as it can influence the emission of greenhouse gases… Planning can also help increase resilience to climate change impact through the location, mix and design of development.*"	The guidance sets climate change allowances to be included in flood risk assessments, which have been considered as part of the design as outlined in **Section 19.4**.
Our Green Future: Our 25-year Plan to Improve the Environment (Ref 19-27)	
The plan sets out the Government's proposed action to help the natural world regain and retain good health. It aims to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats.	Embedded adaptation measures to minimise effects of climate change are set out in **Section 19.9**.
Decarbonising Transport: A Better, Greener Britain (Ref 19-12)	
The plan sets out the Government's commitments and actions needed to decarbonise the transport system in the UK before 2050. The plan proposes to plot a course to net zero for the UK domestic maritime sector, with indicative targets from 2030 and net zero as early as is feasible – public consultation is planned in 2022, followed by strategy 'Course to Zero'; there is also a planned review and refresh of Clean Maritime Plan.	The objective of the Project, as set out in **Chapter 2: The Project [TR030008/APP/6.2]**, is to deliver port infrastructure needed to support the future transportation of liquid bulks associated with the energy sector that would support the transition to net zero. The new jetty would further support sustainable development by providing additional capacity for the development of the renewable energy and carbon capture sectors. Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.9**.

Legislation/Policy/Guidance	Consideration within the ES
North East Lincolnshire Council ("NELC") Environmental Policy Statement (Ref 19-13)	
The statement sets out NELC's priorities in taking action towards consuming resources more efficiently, eliminating waste and supporting & developing the green economy & infrastructure, including a commitment to support environmentally responsive local economic growth.	The Project supports the priorities of developing the green economy and infrastructure. It responds to the requirements set out in policy SO2 Climate Change in the NELC Plan (Ref 19-28) which requires development to address the causes and effects of climate change for example by minimising energy and natural resource use and encouraging opportunities for sustainable transport. Mitigation measures to minimise and mitigate the impacts of GHG emissions on climate change from the Project and embedded adaptation measures to minimise effects of climate change are set out in **Section 19.9**.
North East Lincolnshire Council (NELC) Carbon Roadmap (Ref 19-14)	
The roadmap sets out how the Council plans to achieve its aim to cut its carbon emissions to net zero by 2040 and for North East Lincolnshire to be carbon net zero by 2050.	Mitigation measures incorporated into the Project design, construction and operation to minimise and mitigate the impacts of GHG emissions on climate change from the Project are set out in **Section 19.9**.
North East Lincolnshire Council (NELC) Natural Assets Plan (Ref 19-15)	
The plan sets out how the Council and its partners can improve the area's unique natural environment for the benefit of everyone. The plan sets out eight areas that the Council wants to focus on that will help to adapt and mitigate effects of climate change.	Embedded adaptation measures to minimise effects of climate change are set out in **Section 19.9**. Measures to address the eight areas of the plan are considered. In relation to 'biodiversity and special sites' a Habitats Regulations Assessment for impacts on the Humber Estuary European Marine Site is being undertaken; see **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. Measures to address Water Management are covered in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.
IEMA: Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance (Ref 19-2)	
The guidance aids with the identification, assessment and subsequent mitigation of lifecycle impacts of GHG emissions throughout the Environmental Impact Assessment (EIA) process.	The approach to assessing the significance of GHG emissions from construction and operation of the Project has been undertaken in accordance with this guidance.

Legislation/Policy/Guidance	Consideration within the ES
IEMA: Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation (Ref 19-3)	
The guidance aids with the assessing of the impacts of climate change within project design.	The approach for assessing the significance of climate change risks on the Project has been undertaken in accordance with this guidance.

19.4 Assessment Methodology

Assessment Methodology GHG Assessment

Methodology for Determining Baseline Conditions and Sensitive Receptors

19.4.1 The receptor for GHG emissions is the global climate as the effects of GHG emissions are not geographically constrained. All GHG emissions have the potential to result in a cumulative effect in the atmosphere.

19.4.2 For the GHG assessment, the current and future baseline is the 'business as usual' scenario where the Project is not implemented. The baseline typically considers the GHG emissions from the existing Site operations and the existing carbon stock within the soil and the above- and below-ground vegetation within the Site. The Project description in **Chapter 2: The Project [TR030008/APP/6.2]** has been used to determine the baseline conditions.

Methodology for Determining Demolition, Construction and Operation Effects

19.4.3 The assessment has adopted a Project lifecycle approach to identify 'hot spots' of GHG emissions (i.e. the Project stage(s) likely to generate the largest amount of GHG emissions) and enable priority areas for mitigation to be identified. This approach is consistent with the principles set out in IEMA guidance (Ref 19-2) and PAS 2080 (Ref 19-18).

19.4.4 In line with the World Resources Institute ("WRI") and World Business Council for Sustainable Development ("WBCSD") GHG Protocol guidelines (Ref 19-20), the lifecycle GHG impact assessment has been reported as tonnes of carbon dioxide equivalent (tCO_2e) and has considered the seven Kyoto Protocol gases:

a. Carbon dioxide (CO_2)
b. Methane (CH_4)
c. Nitrous oxide (N_2O)
d. Sulphur hexafluoride (SF_6)
e. Hydrofluorocarbons (HFCs)
f. Perfluorocarbons (PFCs)
g. Nitrogen Trifluoride (NF_3)

19.4.5 Expected GHG emissions arising from Site preparation and construction activities, embodied carbon in materials and operational emissions of the Project have been quantified using a calculation-based methodology as per the following equation and in accordance with the GHG Protocol (Ref 19-20):

Activity data x GHG emissions factor = GHG emissions

19.4.6 A set of standard data quality principles have been applied so that the results from the GHG assessment are as accurate and representative as possible. This has included the selection of emission factors that are representative of the UK construction industry. The Department for Energy Security and Net Zero ("ESNZ") 2023 emissions factors (Ref 19-21) and embodied carbon data from the Inventory of Carbon and Energy V3.0 ("ICE") (Ref 19-22) have been used as the source of emissions factors for calculating GHG emissions. GHG activity data has been gathered directly from the Project's engineering and design teams to enable consistency and completeness of data collection.

19.4.7 The resulting carbon footprint has been compared to the existing baseline condition, details of which are provided in **Section 19.8**, to identify the impact of the Project.

19.4.8 Where GHG activity data was unavailable, assumptions and estimations have been developed. Any assumptions, inclusions and exclusions that inform the GHG emissions calculation have been clearly described in the sections below.

19.4.9 In order to assess the potential impacts of GHG emissions arising from the Project, likely activities have been identified and their associated GHG emissions sources have been estimated. Potential activities related to the Project that could cause GHG emission impacts are presented in **Table 19-3.**

19.4.10 IEMA guidance (Ref 19-2) sets out that projects will sometimes replace existing activity and therefore emissions of a project should be based on its net impact over its lifetime. In **Table 19-3** the displacement of fossil fuel activity from the uptake of imported hydrogen is included to take into account the net impact of the Project.

Table 19-3: Potential sources of GHG emissions

Lifecycle Stage	Activity	Primary Emission Sources
Pre-construction	Onsite pre-construction activity, i.e. enabling works, etc.	GHG emissions from fuel consumption by construction plant and vehicles, generators onsite, and worker commuting
	Transportation and disposal of earthworks/ waste	GHG emissions from transportation and disposal of earthworks/pre-construction waste
	Land clearance	GHG emissions associated with the loss of carbon stock

Lifecycle Stage	Activity	Primary Emission Sources
Product manufacture	Raw material extraction and manufacturing of products/materials	Embodied GHG emissions associated with product and material manufacture
	Transport of products/ materials to Site	GHG emissions from fuel consumption of transportation of products and materials to Site
Construction	Onsite construction activity	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators onsite, and material consumption
	Transport of construction workers	Energy (electricity, fuel, etc.) consumption from worker commuting
	Transportation and disposal of earthworks/ waste	GHG emissions from transportation and disposal/treatment of earthworks/construction waste. This includes vessel movements associated with dredging and waste disposal in the marine environment.
Operations	Operation of the Project	GHG emissions from energy use, process operations, additional traffic, provision of potable water, and treatment of wastewater. GHG emissions from shipping associated with the import and export of ammonia and CO_2.
	Transportation and disposal of waste	GHG emissions from transportation and disposal of waste
	Building and grounds maintenance /maintenance of marine environment	GHG emissions associated with replacement materials/products. This includes vessel movements associated with dredging and waste disposal in the marine environment.
	Emissions displacement	Avoided or displaced emissions through use of any renewable energy systems, including hydrogen use displacing other fuels, or offsetting.
	Landscaping	Changes in GHG emissions/sinks from landscaping and re-vegetation

Lifecycle Stage	Activity	Primary Emission Sources
Decommissioning (of the hydrogen production facility)	Removal and/or renewal of the hydrogen production facility part of the Project	GHG emissions arising from fuel consumption for plant and vehicles and disposal of materials.

Lifecycle GHG Impact Assessment Significance Criteria

Sensitivity of Receptor

19.4.11 The sensitivity of the climate to GHG emissions is considered to be 'high'. The rationale is as follows:

a. GHG emission impacts could compromise the UK's ability to reduce its GHG emissions and therefore the ability to meet its future legally binding carbon budgets.

b. The importance of limiting global warming to below 2°C above industrial levels, while pursuing efforts to limit such warming to 1.5°C as set out in the Paris Agreement (Ref 19-23), is clear. Additionally, a recent report by the Intergovernmental Panel on Climate Change ("IPCC") (Ref 19-24) highlighted the importance of limiting global warming below 1.5°C.

c. Disruption to the global climate is already having diverse and wide-ranging impacts to the environment, society, the economy and natural resources. Known effects of climate change include increased frequency and duration of extreme weather events, temperature changes, rainfall and flooding, and sea level rise and ocean acidification. These effects are largely accepted to be negative, profound, global, likely, long-term to permanent, and are transboundary and cumulative from many global actions.

Magnitude of Impact

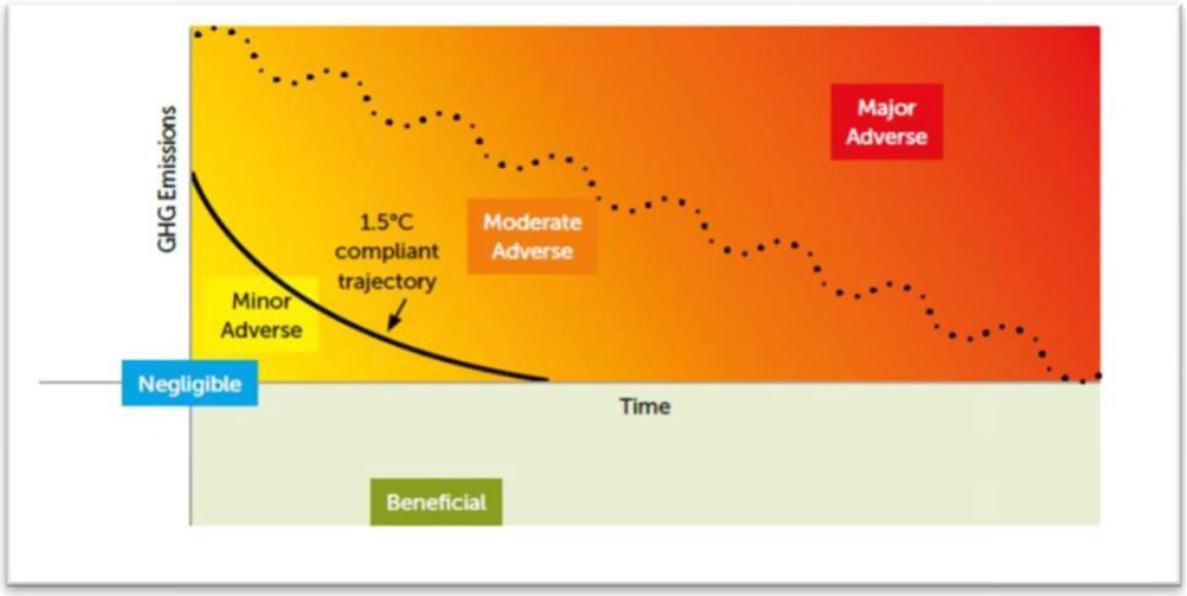
19.4.12 In February 2022, IEMA (Ref 19-2) published a revision of the 2017 IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance. The revision of the guidance has been driven by changes arising from legislation and policy since 2017.

19.4.13 IEMA's publication provides updated and improved guidance, developed by leading practitioners from the past five years of practice on complex projects. The guidance builds on the previous IEMA guidance and reinforces the need to use competent experts for specialist topics such as GHG assessment.

19.4.14 In the revised guidance, mitigation is no longer an element to be considered towards the later stage of the EIA process. Instead, mitigation should be considered from the outset and throughout the Project's lifetime whilst also helping to deliver proportionate EIAs. Once the magnitude of emissions has been determined, mitigation measures should be proposed. Any mitigation measures that are committed to within a proposed development need to be included within the assessment.

19.4.15 The updated guidance describes five distinct levels of significance which are not solely based on whether a project emits GHG, but also how the project makes a relative contribution towards achieving a science-based 1.5°C aligned transition towards net zero. The different levels of significance are plotted against the UK's net zero compatible trajectory as presented in **Plate 19-1** to determine the Project's significance.

Plate 19-1: Different levels of significance plotted against the UK's net zero compatible trajectory (Ref 19-2)



19.4.16 **Table 19-4** presents the different significance levels as per the latest version of IEMA guidance. The guidance emphasises that "*a project that follows* a *'business-as-usual' or 'do minimum'* approach *and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area-based transition targets, results in a significant adverse effect. It is down to the practitioner to differentiate between the 'level' of significant adverse effects e.g. '**moderate'** or '**major'** adverse effects.*" Moderate and Major adverse impacts are considered to be significant, while all other significance levels are deemed to be not significant.

19.4.17 A 'minor adverse' or 'negligible' non-significant effect does not necessarily refer to the magnitude of GHG emissions being carbon neutral (i.e. zero on balance) but refers to the likelihood of avoiding severe climate change, aligning project emissions with a science-based 1.5°C compatible trajectory and achieving net zero by 2050.

19.4.18 A project's impact can shift from significant adverse to non-significant effects by incorporating mitigation measures that substantially improve on business-as-usual and meet or exceed the science-based emissions trajectory of ongoing but declining emissions towards net zero. Where projects cause GHG emissions to be avoided or removed, those projects can be considered beneficial.

Table 19-4: Definition of levels of significance (Ref 19-2)

Significance Level	Effects	Description	Example in the guidance
Significant	Major adverse	A project that follows a 'business-as-usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area based transition targets. It is down to the practitioner to differentiate between the 'level' of significant adverse effects, e.g. 'moderate' or 'major' adverse effects.	The project's GHG impacts are not mitigated or are only compliant with do-minimum standards[1] set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
	Moderate adverse		The project's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type. A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.
Not significant	Minor adverse	A project that is compatible with the budgeted, science based 1.5°C trajectory	The project's GHG impacts would be fully consistent with applicable existing and

[1] Minimum standards here simply indicates that the project aligns with existing regulations, but do not make any further reductions or contribution towards net zero.

Significance Level	Effects	Description	Example in the guidance
		(in terms of rate of emissions reduction) and which complies with up-to-date policy and 'good practice' reduction measures to achieve that. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035 and thereby potentially avoiding significant adverse effects.	emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.	The project's GHG impacts would be reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Significant	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged	The project's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without-project baseline. A project with beneficial effects

Significance Level	Effects	Description	Example in the guidance
		as having a beneficial effect.	substantially exceeds net zero requirements with a positive climate impact.

19.4.19 As noted previously, in accordance with IEMA guidance, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact. In GHG accounting, it is considered good practice to contextualise emissions against pre-determined carbon budgets. The UK has defined national carbon budgets, which have been determined as being compatible with net zero and international climate commitments.

19.4.20 To assess the impact of GHG emissions from the Project, the UK carbon budgets (Ref 19-25) have been used as a proxy for the climate (**Table 19-5**). As this is a Nationally Significant Infrastructure Project ("NSIP"), placing the Project into this context is deemed appropriate. UK carbon budgets are in place to restrict the amount of GHG emissions the UK can legally emit in a five-year period. The UK is currently in the 4th carbon budget period, which runs from 2023 to 2027. The 3rd, 4th and 5th carbon budgets reflect the previous 80% reduction target by 2050. The 6th carbon budget aligns with the legislated 2050 net zero commitment.

19.4.21 To put future emissions from the Project into context with UK's trajectory to net zero by 2050, the Climate Change Committee's ("CCC") balanced net zero pathway is utilised post-2037, in the absence of any nationally legally binding carbon budgets after the subsequent 6th carbon budget.

19.4.22 The CCC balanced net zero pathway is divided into five-year periods post-2037 to match the previous six legally binding UK National Carbon Budgets. The proposed carbon budget periods derived from the net zero pathway encompass the 7th, 8th and 9th indicative budget periods up to 2050 in line with the UK's 1.5°C trajectory as detailed in **Table 19-5**.

19.4.23 However, the supplementary carbon budgets beyond 2037 have not been formally adopted by the Government or ratified by parliament and can only be used as an indicative measure to contextualise the Project's progress compared to the national net zero trajectory.

19.4.24 While national carbon budgets can provide context on the scale of the Project's GHG emissions, this assessment appraises significance of effects based on the combined measures of embedded mitigation, the emissions trajectory, and policy alignment of the Project.

Table 19-5: UK Carbon Budgets and indicative UK carbon budgets based upon the CCC's balanced net zero pathway

Carbon budget	UK Carbon Budget ($MtCO_2e$)	Indicative Carbon Budgets based upon the CCC's balanced net zero pathway ($MtCO_2e$)
3rd (2018–2022)	2,544	-
4th (2023–2027)	1,950	-
5th (2028–2032)	1,725	-
6th (2033–2037)	965	-
7th (2038–2042)	-	526
8th (2043–2047)	-	195
9th (2048–2050)		17

Assessment Methodology CCR Assessment

Methodology for Determining Baseline Conditions and Sensitive Receptors

19.4.25 The receptor for the Climate Change Resilience ("CCR") review is the Project during construction and operation, including both workers and infrastructure.

19.4.26 The current baseline has been established by understanding the historic/current climate in the location of the Project by reviewing climate data obtained from the Met Office website. The climate baseline has been developed using Met Office data obtained from the meteorological station closest to the Project (Cleethorpes) (Ref 19-16).

19.4.27 The future baseline has been established using UKCP18 (Ref 19-19). UKCP18 data for the 25km grid cell where the Project is located has been used to examine future climate parameters. This climate projection data provides a probabilistic indication of how global climate change is likely to affect the Project using defined climate variables and time periods.

Methodology for Determining Effects of Climate Change on the Project

19.4.28 Climate parameters considered in the CCR assessment during the demolition, construction and operation of the Project include the following:

a. Extreme weather events.
b. Flood risk.
c. Sea level rise ("SLR").
d. Temperature change.
e. Rainfall change.

19.4.29 The CCR assessment has qualitatively reviewed the Project's resilience to climate change considering the UKCP18 projections (Ref 19-17) for the geographical location and timeframe of the Project (including demolition, construction and operation).

19.4.30 The CCR assessment has been undertaken for the Project to identify potential climate change impacts on the Project and associated receptors, and to consider their potential consequence and likelihood of occurrence, taking account of the measures incorporated into the design of the Project.

19.4.31 Climate change projections for the Project during the enabling works and construction phase have been examined against receptors during this stage. Construction phase receptors of the Project include the workforce, plant, machinery and materials.

19.4.32 For the operational phase of the Project, potential climate change impacts have been identified using relevant projections from UKCP18 and the CCR assessment considers their potential consequence to receptors and likelihood of occurrence, taking account of the measures incorporated into the design of the Project. Receptors when the Project is complete may include the workforce, Project assets and their operation, maintenance and refurbishment.

19.4.33 The following key terms and definitions relating to the CCR assessment have been used:

a. Climate event – a weather or climate related event, for example increased winter precipitation.

a. Climate hazard – a weather or climate related event, which has potential to do harm to environmental or community receptors or assets.

b. Climate change impact – an impact from a climate hazard which affects the ability of the receptor or asset to maintain its function or purpose.

c. Consequence – any effect on the receptor or asset resulting from the climate hazard having an impact.

19.4.34 A stepped approach is used to assess the impacts of climate change on the Project.

a. Identify climate events.

b. Identify likelihood of climate hazard occurring.

c. Identify likelihood of climate impact occurring.

d. Identify consequence of impact on the Project.

e. Identify significance of impact (likelihood of impact occurring x consequence of impact).

19.4.35 The likelihood of a climate event occurring would be identified based on data extracted from UKCP18 for the climate parameters identified in **Paragraph 19.4.28**.

19.4.36 The criteria which have been used to determine the likelihood of a climate change hazard occurring as a result of a climate event are detailed in **Table 19-6**. The event is defined as the climate event (such as heatwave), while the hazard is defined as an impact on the Project caused by the climate event (such as overheated electrical equipment).

Table 19-6: Probability of likelihood of climate change hazard occurring

Likelihood of event	Description (probability of occurrence)
High	90–100% probability that the hazard will occur.
Moderate	33–90% probability that the hazard will occur.
Low	10–33% probability that the hazard will occur.
Negligible	0–10% probability that the hazard will occur.

19.4.37 Following identification of climate hazards, the likelihood and consequences of the impact have been assessed according to **Table 19-7** and **Table 19-8** respectively**.** The categories and descriptions provided below are based on the IEMA climate change resilience and adaptation guidance (Ref 19-3).

19.4.38 **Section 19.7** presents mitigation measures (based on those identified by each technical discipline) to demonstrate how the Project has been or will be adapted to increase its resilience to future climate conditions.

Table 19-7: Description for the likelihood of the climate-related impact occurring

Likelihood category	Description
High	Likelihood of climate hazard occurring is high and impact is always/almost always going to occur.
Moderate	Likelihood of climate hazard occurring is moderate and impact of the climate hazard is as unlikely as it is likely to occur.
Low	Likelihood of climate hazard occurring is low, impact rarely occurs.
Negligible	All other eventualities – highly unlikely but theoretically possible.

Table 19-8: Description of consequences

Consequence of impact	Description
High	Significant disruption to construction and operations, unable to deliver services, resulting in high financial losses.
Moderate	Disruption to construction and operations and ability to deliver services, resulting in some financial losses/cost implications.
Low	Minor disruption to construction and operations but does not significantly impact ability to deliver services.

Consequence of impact	Description
Negligible	Negligible disruption to construction and operations, does not impact ability to deliver services.

CCR Assessment Significance Criteria

19.4.39 The CCR Review has assessed the significance of effects by evaluating the combination of the likelihood of the climate-related impact occurring, and the consequence, as per the risk assessment matrix in **Table 19-9**. The assessment has taken into account confirmed design and mitigation measures (referred to as embedded mitigation).

19.4.40 Following identification of climate hazards, the likelihood and consequences have been assessed according to **Table 19-7** and **Table 19-8** respectively. The categories and descriptions provided below are based on the IEMA climate change resilience and adaptation guidance (Ref 19-3).

Table 19-9: Significance of effect matrix (where 'S' is significant and 'NS' is not significant)

		Likelihood of climate-related impact occurring			
		Negligible	Low	Moderate	High
Measure of consequence	Negligible	NS	NS	NS	NS
	Low	NS	NS	NS	S
	Moderate	NS	NS	S	S
	High	NS	S	S	S

Assessment Methodology ICCI Assessment

Methodology for Determining Baseline Conditions and Sensitive Receptors

19.4.41 The ICCI assessment has considered the ways in which projected climate change will influence the significance of the effect of the Project on receptors in the surrounding environment. The approach is consistent with the principles set out in the IEMA guidance (Ref 19-2).

19.4.42 The ICCI assessment has considered the existing and projected future climate conditions for the geographical location and assessment timeframe. It identifies the extent to which identified receptors in the surrounding environment are potentially vulnerable to and affected by these factors. The receptors for the ICCI assessment are those that will be impacted by the Project. These impacts have been assessed in liaison with the technical specialists responsible for preparing the applicable technical chapters **[TR030008/APP/6.2]**, listed below:

a. Chapter 6: Air Quality

b. Chapter 7: Noise and Vibration
c. Chapter 8: Nature Conservation (Terrestrial Ecology)
d. Chapter 9: Nature Conservation (Marine Ecology)
e. Chapter 10: Ornithology
f. Chapter 11: Traffic and Transport
g. Chapter 12: Marine Transport and Navigation
h. Chapter 13: Landscape & Visual Impact
i. Chapter 14: Historic Environment (Terrestrial)
j. Chapter 15: Historic Environment (Marine)
k. Chapter 16: Physical Processes
l. Chapter 17: Marine Water and Sediment Quality
m. Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage
n. Chapter 20: Materials and Waste
o. Chapter 21: Ground Conditions and Land Quality
p. Chapter 22: Major Accidents and Disasters
q. Chapter 23: Socio-economics
r. Chapter 24: Human Health and Well-being

19.4.43 Once potential ICCIs have been identified in relation to the Project, the likelihood of their occurrence during construction, operation, and decommissioning phases is categorised. This is the same process as was undertaken for the CCRA, as detailed in **Paragraphs 19.4.25** to **19.4.40**.

19.4.44 Taking account of the likelihood of the climate risk occurring, and the sensitivity of the receptor, the likelihood of an impact occurring to the receptor is then defined. This includes consideration of any embedded mitigation measures and good practice. These classifications are defined in **Table 19-7.**

19.4.45 Once the likelihood of an ICCI has been identified, the assessment then considers how this will affect the significance of the identified effects.

19.4.46 The ICCI consequence criteria are defined in **Table 19-10** and are based on the change to the significance of the impact already identified by the environmental discipline. To assess the consequence of an ICCI each discipline has assigned a level of consequence to an impact based on the criteria description and their discipline assessment methodology.

Table 19-10: Consequence criteria for ICCI assessment

Consequence	Consequence criteria
High	The climate change parameter in-combination with the effect of the Project causes the significance of the effect of the Project on the resource/receptor, as defined by the topic, to increase from negligible, low or moderate to high.
Moderate	The climate change parameter in-combination with the effect of the Project causes the significance of the effect defined by the topic, to increase from negligible or low, to moderate.
Low	The climate change parameter in-combination with the effect of the Project, causes the significance of the effect defined by the topic, to increase from negligible to low.
Very Low	The climate change parameter in-combination with the effect of the Project does not alter the significance of the effect defined by the topic.

ICCI Assessment Significance Criteria

19.4.47 The significance of effects is determined using the matrix in **Table 19-11**. This assesses the significance by evaluating the combination of the likelihood of the impact occurring and the consequence (where 'S' is significant and 'NS' is not significant).

Table 19-11: Significance of effect matrix (where 'S' is significant and 'NS' is not significant)

Significance		Likelihood of climate-related impact occurring			
		Negligible	Low	Moderate	High
Level of consequence	Very Low	NS	NS	NS	NS
	Low	NS	NS	NS	S
	Moderate	NS	NS	S	S
	High	NS	S	S	S

Limitations and Assumptions

19.4.48 The information presented in this assessment reflects that obtained and evaluated at the time of reporting and is based on the proposed parameters/ plans for the Project and the maximum likely extents of land required for its construction and operation to define a reasonable worst case for assessment.

Limitations of the Lifecycle GHG Impact Assessment

19.4.49 The information gathered to date is considered sufficient to provide the basis for a robust EIA. However, the assessment has taken into consideration assumptions and limitations, as outlined in **Table 19-12**. For each limitation, an explanation of the possible impact of the limitation has been provided, as well as a description of any corrective actions that have been taken to adjust for any limitations.

Table 19-12: Limitations within the Lifecycle GHG Impact Assessment

Limitation	Impact of limitation	Correction for limitation
The GHG impact assessment is taking place before construction has begun. There will be some uncertainty regarding the types and quantities of materials to be used in construction, which will require assumptions to be applied.	The construction emissions estimate may not reflect the final detailed design. Planning for the construction phase will continue to develop, and therefore a worst-case approach has been taken to account for any uncertainty, in line with suggestions in IEMA guidance (Ref 19-2).	A worst-case approach (e.g. assumed diesel is used for all plant equipment) has been taken to deal with any uncertainty in parameters throughout assessment.
There is currently no specific guidance specifying a quantified threshold of carbon emissions, which if exceeded, is considered significant.	Assessment of significance of emissions cannot be judged objectively.	The assessment has used a combination of approaches. The GHG emissions are put into context using the national carbon budgets. In addition to this, using the latest version of IEMA guidance (Ref 19-2) the significance of emissions will be assessed based on "*whether* [the Project] *contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050*".
The GHG impact assessment is taking place before all of the likely users of the Project are identified.	The origin, quantity and transport distance of ship movements may vary throughout the Project's lifecycle.	It has been assumed that the shipping movements will reflect the full capacity of the Project at 292 shipping movements, in order to be conservative as in practice this is unlikely to be achieved due to requirements in docking time.

19.4.50 Some details of the construction methodology of the Project have not been finalised at this stage. As a result, data is not available to provide a fully quantified assessment of the GHG emissions from the enabling/construction and operation of the Project. Accordingly, appropriate industry estimates and averages have been used for the purposes of this assessment, all of which are detailed below.

Assumptions Made in the Lifecycle GHG Impact Assessment

19.4.51 The following assumptions, inclusions and exclusions, have been used in the calculation of GHG emissions for the construction and operation phases:

a. Materials quantities were provided by the design team to inform the quantified GHG assessment for the Project. These quantities reflected a number of assumptions (e.g. mileage incurred by worker transport, energy usage for buildings) which were incorporated into the GHG assessment. These assumptions were based on the design information at the time this assessment was undertaken.

b. The quantity of material waste has been estimated based on the construction material quantities provided. Aligned with **Chapter 20: Materials and Waste [TR030008/APP/6.2]**, a 2.5% wastage rate has been applied for asphalt and concrete, and a 5% wastage rate has been applied for other materials. For steel used for structural and piles, no wastage rate has been applied. An overall recovery rate of 90% has been assumed for all waste. A landfill emission factor has been used to assume a worst-case scenario for the remaining 10% of waste.

c. The assumed distance for worker transport is 15 miles each way per day for local personnel and 115 miles each way per day for non-local personnel. The assumed distance for worker transport for the jetty construction is 50km round-trip per worker. It is assumed all transport for all workers would be by an average petrol car. There are commitments to using minibuses and encouraging cycling in the Construction Traffic Management Plan, however this assumption of petrol car is used as a worst case scenario.

d. There are a series of assumptions for shipping sizes, imported material and origin as follows:

    i. 660,000 tonnes of capacity would be used for the import of green ammonia for the hydrogen production facility (comprising 12 ships each transporting 55,000 tonnes) from the Middle East and Netherlands.

    ii. It is also assumed that there would also be approximately 9,800,000 tonnes of CO_2 which are imported from a distance of approximately 500 nautical miles.

    iii. It is also assumed that would be a domestic (UK) re-export likely to occur to three port destinations (Teesport, Port Talbot, Cardiff) with an assumed 5,000,000 tonnes re-exported to the furthest distance port (Port Talbot). Only 100,000 tonnes of the exports are likely to be related to Air Products shipping of ammonia.

iv. All distances travelled are assumed as one-way only, with ship fuel type assumed as Liquefied Petroleum Gas. The future origins and destinations are however likely to vary substantially based on individual future jetty users and their patterns of operation. The current shipping assumptions are considered to be a realistic worst case, based on current knowledge available.

e. The manufacturing process for green ammonia, including the electrolysis of water into hydrogen and the synthesis of ammonia itself is powered by renewable electricity. The overall greenhouse gas impact of the manufacturing process is therefore very low.

f. Material transport: assumptions are based on the distance construction materials are likely to be transported to the Project from estimates provided by Air Products. Specific distances were provided for different types of materials ranging from 10km (e.g. pipe supports, gravel) to 3,000km (shipping equipment).

g. The assumption for operation energy and water usage are based on estimates provided by Air Products. The Terminal and hydrogen production facility are assumed to be running 24 hours per day, seven days a week and 365 days a year.

h. It is assumed that operational dredging requirements are minor and therefore are not quantified as part of the assessment.

i. The 300MW hydrogen produced from the site is assumed to displace the equivalent energy from diesel in Heavy Goods Vehicle (“HGV”) transport, however there is potential for local industrial use.

Limitations of the CCR and ICCI Assessment

19.4.52 The information gathered to date is considered sufficient to provide the basis for a robust EIA. The assessment has taken into consideration assumptions and limitations, as outlined in **Table 19-13**. For each limitation, an explanation of the possible impact of the limitation has been provided, as well as a description of any corrective actions that will be taken to adjust for any limitations.

Table 19-13: Limitations within the CCR and ICCI Assessment

Limitation	Impact of limitation	Correction for limitation
The CCR assessment is taking place before construction has begun. There will be some uncertainty regarding the selection of materials and design to be used for the Project, which will require assumptions to be applied.	Whilst a full assessment based on final designs is not possible at this stage, it is possible to consider the impacts of climate change taking into account the location and type of Project.	The impact of climate change on the Project has been assessed to reflect worst-case circumstances and account for potential design changes. The CCR and ICCI assessment are conducted as per the latest design data available.

19.4.53 There are uncertainties within the climate change projections in the CCR and ICCI assessment due to the complexity of the climate system, natural climate variability, uncertainty over future GHG emission levels and modelling uncertainties. Climate change projection data from the UKCP18 has been used to identify climate hazards, trends and magnitude of change at the regional scale. To account for uncertainties, climate projections at the 10%, 50% and 90% probability levels have been considered.

19.4.54 Information on climate change effects on wind speed is not available in UKCP18 for probabilistic data and therefore a qualitative assessment has been provided based on professional judgement.

19.5 Study Area

19.5.1 The Study Area for the Lifecycle GHG impact assessment includes:

a. Direct GHG emissions arising within the Site Boundary.

b. Direct GHG emissions arising from shipping associated with the import and export of green ammonia and carbon dioxide.

c. Indirect GHG emissions occurring offsite such as embodied carbon in construction materials. It is not known where the materials will be sourced therefore this could be global.

d. Indirect GHG emissions displacement from use of hydrogen replacing fossil fuels that would be used in the 'without proposed development' scenario.

19.5.2 The Study Area for the CCR assessment comprises the Project (temporary and completed works).

19.5.3 The ICCI assessment considers sensitive receptors identified by other environmental disciplines. The Study Area for the ICCI assessment is therefore as identified by each discipline for their individual assessments.

19.6 Baseline Conditions

Current Baseline

Lifecycle GHG Impact Assessment

19.6.1 The current baseline for the lifecycle GHG impact assessment is a 'business as usual' scenario where the Project does not go ahead.

19.6.2 The existing Project conditions are explained in **Chapter 2: The Project [TR030008/APP/6.2]**. The terrestrial parts of the Project are a mosaic of brownfield uses and former arable land. There is also woodland present, some of which will need to be removed to form the jetty access road and the pipeline corridor. Any emission resulting from this land use change are calculated in the assessment.

19.6.3 Emissions from the operation of the existing Project are negligible, however the wider whole life carbon of the baseline is assumed to include diesel which will be displaced by Hydrogen. The baseline emissions are those related to generating 300MW of diesel which would continue in a business as usual case without the Project going ahead.

CCR Assessment

19.6.4 The baseline for the CCR assessment considers how resilient the Project is to current and projected future climate hazards.

19.6.5 The existing baseline for the CCR assessment is based on climate data obtained from the Met Office recorded by the closest meteorological station to the Project (namely Cleethorpes, located approximately 16km from the Project) for the period 1981–2010 (Ref 19-16) (refer to **Table 19-14**).

Table 19-14: Climate data for the climate station: Cleethorpes (1981–2010) (Ref 19-16)

Climatic Variable	Month	Value
Average annual maximum daily temperature (°C)	-	13.6
Warmest month on average (°C)	July, August	20.7
Coldest month on average (°C)	January	1.7
Mean annual rainfall levels (mm)	-	587.9
Wettest month on average (mm)	November	60.2
Driest month on average (mm)	February	38.0

ICCI Assessment

19.6.6 The baseline for the ICCI assessment is founded upon the climate data detailed in the CCR assessment combined with the baseline for topic assessments.

Future Baseline

Lifecycle GHG Impact Assessment

19.6.7 The future baseline for the lifecycle GHG impact assessment is a ‘business as usual’ scenario where the Project does not go ahead. There are no future baseline emissions from the Project site, the wider emissions considered in a scenario where the project does not go ahead include emissions from 300 MW of diesel in HGV transport.

CCR and ICCI Assessment

19.6.8 The future baseline for both CCR and ICCI assessment is based on the future UKCP18 data from the Met Office (Ref 19-19-19). The latest set of UK Climate projections has been used in accordance with the principles set out in NPSfP (Ref 19-9). This projection data provides probabilistic indications of how global climate change is likely to affect areas of the UK using pre-defined climate variables and time periods.

19.6.9 For the purpose of the assessment, UKCP18 probabilistic projections for pre-defined 30-year periods for the following average variables have been obtained and analysed:

a. Mean annual temperature.
b. Mean summer temperature.
c. Mean winter temperature.
d. Maximum summer temperature.
e. Minimum winter temperature.
f. Mean annual precipitation.
g. Mean summer precipitation.
h. Mean winter precipitation.
i. Sea Level Risk (SLR).

19.6.10 Projected temperature and precipitation variables are presented in **Table 19-15**, **Table 19-16** and **Table 19-17**, respectively. UKCP18 probabilistic projections (RCP 8.5) have been analysed for the 25km grid square in which the Project is located. These figures are expressed as temperature/precipitation anomalies relative to the 1981–2010 baseline.

Table 19-15: Projected changes in temperature variables (°C), 50% probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020–2049	2040–2069
Mean annual air temperature anomaly at 1.5m (°C)	1.04 (0.49, 1.61)	1.82 (0.95, 2.73)
Mean summer air temperature anomaly at 1.5m (°C)	1.25 (0.45, 2.02)	2.20 (0.99, 3.41)
Mean winter air temperature anomaly at 1.5m (°C)	0.92 (0.17, 1.72)	1.62 (0.49, 2.82)
Maximum summer air temperature anomaly at 1.5m (°C)	1.37 (0.28, 2.37)	2.39 (0.85, 3.95)

Climate Variable	Time Period	
	2020–2049	2040–2069
Minimum winter air temperature anomaly at 1.5m (°C)	0.94 (0.11, 1.87)	1.72 (0.42, 3.14)

Table 19-16: Projected changes in precipitation variables (%), 50% probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020–2049	**2040–2069**
Annual precipitation rate anomaly (%)	0.50 (-6.63, 7.52)	-2.36 (-11.3, 6.73)
Summer precipitation rate anomaly (%)	-4.04 (-21.43, 14.36)	-14.31 (-36.47, 8.49)
Winter precipitation rate anomaly (%)	4.13 (-4.29, 13.37)	7.32 (-4.23, 20.52)

Table 19-17: Projected changes in sea level variables, 50% probability (10% and 90% probability in parentheses)

Climate Variable	Time Period	
	2020–2049	**2040–2069**
Time-mean sea level anomaly (m)	0.18 (0.13, 0.23)	0.29 (0.22, 0.41)

19.6.11 UKCP18 uses a range of possible scenarios, classified as Representative Concentration Pathways ("RCPs"), to inform differing future emission trends. These RCPs "… specify concentrations of greenhouse gases that will result in total radiative forcing increasing by a target amount by 2100, relative to pre-industrial levels." RCP8.5 has been used for the purposes of this assessment as a worst-case scenario.

19.6.12 Total radiative forcing is the difference between the incoming and outgoing radiation at the top of the atmosphere. Radiative forcing targets for 2100 have been set at 2.6, 4.5, 6.0 and 8.5 watts per square metre (Wm-2) to span a wide range of plausible future emissions scenarios and these targets are incorporated into the names of the RCPs: RCP2.6, RCP4.5, RCP6.0 and RCP8.5. Each pathway results in a different range of global mean temperature increases over the 21st century.

19.6.13 As the design life of the Project is at least 25 years, the CCR assessment has considered scenarios that reflect a high level of GHG emissions at the 10%, 50%, and 90% probability levels of the climate variables up to 2069 to assess the impact of climate change over the lifetime of the Project.

19.6.14 It is generally concluded that extreme weather events, including intense and/or prolonged precipitation, storm events and poor sea conditions, will increase in frequency, but the low confidence in the climate change projections means that it is difficult to predict the likely changes with confidence (Ref 19-17). Under the assumptions adopted for this assessment, it is considered that extreme weather will become more frequent.

19.7 Development Design and Impact Avoidance

Lifecycle GHG Impact Assessment

Embedded Mitigation Measures

19.7.1 The Project has been designed, as far as possible, to avoid and minimise impacts and effects to climate through the process of design development, and by embedding mitigation measures into the design.

19.7.2 Best available techniques for energy management will be required to be adopted as part of compliance with the Environmental Permit including:

a. Plant advanced control and optimisation.

b. Use of insulation and superinsulation to minimise heat leak into the system.

c. Predictive maintenance systems to ensure optimal compressor and equipment running.

d. All plant at the installation to be subject to the preventative maintenance programme which ensures that operational efficiency is maintained.

e. High integrity plan to minimise fugitive emissions.

f. High plant reliability for optimal plant performance reducing start up and shut down.

g. Use of energy efficient lighting.

CCR and ICCI Assessment

Embedded Mitigation Measures

19.7.3 The Project has been designed, as far as possible, to avoid and minimise impacts and effects of climate change through the process of design development, and by embedding mitigation measures into the design.

19.7.4 The following embedded mitigation measures will be secured through the design development of the Project and are addressed in **Appendix 18.A [TR030008/APP/6.4]** Flood Risk Assessment (“FRA”):

a. Flood resistant/resilient design.

b. Raising external ground levels.

c. Elevating critical plant equipment and/or internal finished floor levels above the peak flood inundation level.

Standard Mitigation Measures

19.7.5 A risk assessment of severe weather impacts on the construction process will be produced by the main contractor to inform the need for construction mitigation measures. Any receptors and/or construction-related operations and activities potentially sensitive to severe weather events will be considered in the risk assessment. Climate change projections will also be considered in the risk assessments. The mitigation measures will be secured through the Construction Environment Management Plan ("CEMP") which must be produced (an Outline CEMP has been provided as part of the Development Consent Order ("DCO") Application **[TR030008/APP/6.5]**).

19.7.6 As detailed in the CEMP, the contractor will implement and maintain an 'Environmental Management System ("EMS"), which will consider all measures deemed necessary and appropriate to manage severe weather events and would as a minimum cover training of personnel and prevention and monitoring arrangements. These would include (as required):

a. Use of storm defences (e.g. walls, riprap).

b. Designing the Project with refuges and storm-resilient materials and form.

c. Ensuring appropriate storage of plant and materials.

19.7.7 As appropriate, construction method statements will also consider severe weather events where risks have been identified. The design of tall structures and jetties will be reviewed to ensure stability of tall structures in stronger wind and wave actions.

19.7.8 Risk for crane work will be assessed to make sure the impact of increased wind speeds and gusts are adequately covered.

19.7.9 Prevention measures and health and safety plans will be developed to prevent worker exhaustion due to heat, and manage flood risk during construction.

19.7.10 Regular maintenance of assets will be undertaken to detect deterioration and damage during operation.

19.8 Assessment of Likely Impacts and Effects

Lifecycle GHG Impact Assessment

19.8.1 When assessing the GHG effects of the Project consideration has been given to the emissions and emissions displacement identified in **Paragraph 19.5.1**. The assessment has identified that in alignment with IEMA criteria from **Table 19-4**, construction and operation of the Project is likely to result in **beneficial, significant** effects on the climate.

19.8.2 As discussed in **Paragraphs 19.8.10** to **19.8.25**, the direct emissions of constructing and operating the Project will be exceeded by the carbon reduction benefits the Project will bring in its contribution to the UK achieving its net zero targets by 2050. There is likely to be additional benefits from carbon sequestration, though this is less certain so is not included in the quantitative assessment of the project.

Effects During Construction

19.8.3 The construction works are divided into two parts, terrestrial and marine, anticipated to last a total of 11 years. The terrestrial components are anticipated to be constructed in phases and comprise land-side infrastructure (including pipeline areas, liquid storage tanks, converters and other supporting infrastructure). The marine components include a jetty with a single berth, to be constructed over three years. Details of the construction works can be found in **Chapter 2: The Project [TR030008/APP/6.2]**.

19.8.4 In order to assess the magnitude of the impact of the Project on the climate, GHG emissions associated with the construction of the Project have been calculated based on the methodologies discussed in **Section 19.4**.

19.8.5 As detailed in **Table 19-18**, the total GHG emissions estimated to be emitted from the 11-year construction period associated with the Project have been calculated to be 830,306 tCO_2e. The construction programme is set out in **Chapter 2: The Project [TR030008/APP/6.2]** and it is assumed all of the phases, both marine and terrestrial, are built out in accordance with that programme. For the purpose of putting emissions into context with carbon budget periods, construction emissions have therefore been averaged out per annum. Average annual emissions are expected to be 67,442tCO_2e for terrestrial construction and 29,480tCO_2e for marine construction.

19.8.6 All these emissions are considered ‘additional’ and are included in the impact assessment of the Project as they would not occur if the Project did not go ahead.

19.8.7 The majority of marine component GHG emissions (approximately 79%) are associated with embodied carbon in construction materials. Around half of terrestrial emissions (approximately 56%) are associated with construction activities.

Table 19-18: Enabling works and construction estimated GHG emissions

Emission Source	Terrestrial		Marine	
	GHG Emissions (tCO_2e)	GHG Emissions as a proportion of emissions generated throughout the construction (11 years)	GHG Emissions (tCO_2e)	GHG Emissions as a proportion of emissions generated throughout the construction (3 years)
Preconstruction (A0)	16,797	2.3%	N/A	-
Construction Materials (A1-A3)	288,550	38.9%	70,140	79.3%
Transportation of Materials (A4)	2,121	0.3%	850	1.0%
Worker Transport (A4)	17,924	2.4%	846	1.0%
Waste (A4-A5)	118	0.0%	6,748	7.6%
Construction Activities (A5)	416,357	56.1%	9,856	11.1%
Total GHG emissions over construction period (tCO_2e)	741,866	-	88,360	-
Average annualised GHG emissions during construction (tCO_2e)	**67,422**	-	**29,453**	-

Significance of GHG Emissions during Construction

19.8.8 As stated in **Section 19.4**, all GHG emissions are considered to contribute to climate change. To contextualise the level of significance for the Project the total estimated annual GHG emissions during the construction period for both the terrestrial and marine components is compared to the percentage contribution of the annual budget within each Carbon Budget period. With reference to the UK national carbon budgets, the construction programme falls within three carbon budgets (4th, 5th and 6th), and equates to less than 0.02% of each budget (**Table 19-19**).

Table 19-19: Contribution of construction GHG emissions to the UK Carbon Budgets

Carbon Budget	UK Carbon Budget (tCO_2e)	Potential Project Emissions (tCO_2e)	Percentage Contribution of Construction Emissions to the UK Budget
4th (2023–2027)	1,950,000,000	358,209	0.018%
5th (2028–2032)	1,765,000,000	337,212	0.019%
6th (2033–2037)	965,000,000	134,885	0.014%

19.8.9 Based on **Table 19-4** and **Table 19-5,** the significance of construction GHG emissions is considered to be minor adverse and therefore not significant, as per the latest version of IEMA guidance. The Project's GHG impacts would be fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.

Effects During Operation of Project

19.8.10 The overall lifetime operational emissions, including energy consumption, port transport, commuting, and shipping (import and export), are calculated to be a total of **4,141,333 tCO_2e** over an assumed 25-year operating lifespan (see **Table 19-20**) taking account of the assumptions set out in **paragraph 19.4.51** above.

19.8.11 Diesel in road transport results in the emission of approximately 94g CO_2e per MJ, Therefore, if the 300MW of hydrogen were to be used solely in fuel for vehicles replacing diesel, there would be an estimated emissions saving of 704,634tCO_2e/year totalling a 21,757,414 tCO_2e emission reduction over 25 years.

19.8.12 An additional benefit of fuel switching for diesel road vehicles would be a reduction in emissions of other atmospheric pollutants. Applying the assumptions above, this could cut emissions of particulate (PM_{10}) (26 tonnes/year) and NO_x emissions (1050 tonnes/year), based on replacement vehicles complying with the latest Euro VI standards. In practice the actual savings could be substantially greater as cleaner engine technologies are developed.

19.8.13 Shipping emissions were calculated using the Department for Energy Security and Net Zero (“ESNZ”) emission factors for LPG tankers (Ref 19-21). It is expected that shipping will decarbonise with net-zero and low-carbon shipping fuels in the near future, as the International Maritime Organization (“IMO”), the UN body responsible for shipping, has set a target to reduce emissions per transport work by 40% by 2030 Ref 19-29, compared to 2008 baseline. In their Fourth Greenhouse Gas Study, they found that 29.4% reduction had already been made, meaning a further 10.6% reduction will be made by 2030. Further to that, the UK has committed to including shipping in its sixth carbon budget and set a target of net zero shipping by 2050 Ref 19-12. Based on this shipping

emissions have been reduced in line with the committed trajectories in **Table 19-20**.

19.8.14 The ammonia imports relate to an anticipated 12 out of 292 shipping movements at the jetty, and the shipping emissions related to ammonia transport, imports and exports, are estimated at 328,070tCO_2e over the 25-year lifecycle of the Project. The landside emissions associated with the hydrogen production are 105,988tCO_2e/year or 2,649,693tCO_2e over 25 years. The hydrogen is likely to be used locally for industrial uses or sold as a renewable transport fuel. In terms of emission displacement, the emissions factor (i.e. the rate of greenhouse gas emissions) of the green hydrogen produced by the Project if used directly for industrial uses locally (distributed by pipeline) will be compliant with the UK's standard for low carbon hydrogen, i.e. less than 20 gCO_2e/MJ (Ref 19-26) or, if distributed and sold as a renewable transport fuel, less than 32.9gCO_2e/MJ compliant with the Renewable Transport Fuel Obligation ("RTFO") (Ref 19-30) at the refuelling station.

19.8.15 Additional potential uses of the jetty for carbon dioxide imports and exports to facilitate storage will also assist the transition towards a net zero trajectory. This is not included in the quantitative assessment. With an expected shipping import of 9.8 million tonnes a year there is likely to be enablement of additional reductions in GHG. These benefits have not been quantified, however the shipping emissions are quantified as detailed in **paragraph 19.4.51**.

19.8.16 Shipping emissions presented in **Table 19-20** account for total estimated shipping use for the proposed terminal over the Project assessment period.

Table 19-20: Estimated emissions from operational energy use of Project (25-year period)

Emissions Source	Emissions (tCO_2e)	% of Operation Emissions
B1 – Use		
Sea Freight Transport (Ammonia Imports) (B1)	320,324	7.7%
Sea Freight Transport (Non-ammonia Imports)	518,810	12.5%
Sea Freight Transport (Ammonia Exports) (B1)	7,747	0.2%
Sea Freight Transport (Non-ammonia Exports) (B1)	379,583	9.2%
Port Transport (B1)	218,995	5.3%
B6&7 – Operational Energy Use		
Operational Energy Use – Port Facilities (Electricity, Gas, Water)	2,649,693	64.0%

Emissions Source	Emissions (tCO_2e)	% of Operation Emissions
(B6&7) and hydrogen production facility		
B9 – Utilisation of infrastructure		
Worker Commuting	46,181	1.1%
Total GHG Emissions (tCO_2e)	**4,141,333**	-
Total GHG Emissions Annualised (tCO_2e)	**165,653**	-
Benefits from hydrogen displacement of HGV fuel	**21,757,174**	
Net Emissions (tCO_2e)	**-17,615,842**	

Significance of GHG Emissions from Operation

19.8.17 Overall the impact of the Project is **beneficial** due to the benefits from hydrogen displacing fossil fuels. As stated in **Section 19.4**, all GHG emissions are considered to contribute to climate change. To contextualise the level of significance for the Project, these emissions have been compared to UK national carbon budgets (**Table 19-21**).

19.8.18 The total estimated annual GHG emissions during the operational period for both the terrestrial and marine components is compared to the UK Carbon Budget within each Carbon Budget period. It is assumed that the Project is fully operational in 2035. With reference to the UK national carbon budgets, the period of construction falls within three carbon budget (4th, 5th and 6th) and equates to less than 0.1% of each relevant budget.

19.8.19 Note that whilst the contribution of Project emissions to the 9th carbon budget total for the period 2048–2050 is significant, it would be expected that the major emission sources would likely decarbonise by 2050. The majority of emissions associated with operational energy (98%) come from natural gas, this would be expected to be displaced by low carbon fuels such as hydrogen or electricity at least by 2048. Similarly transport associated with worker commuting and port transport, which is predominantly fossil fuel based today, would likely be displaced by electric vehicles or hydrogen vehicles at least by 2048.

Table 19-21: Contribution of operation GHG emissions to the UK Carbon Budgets

Carbon Budget (7th, 8th and 9th budgets are not committed in law but forecasts)	UK Carbon Budget (tCO_2e)	Potential Project Emissions (tCO_2e)	Percentage Contribution of Operation Emissions to the UK Budget
6th (2033–2037)	965,000,000	779,047	0.08%
7th (2038–2042)	526,000,000	1,094,000	0.21%
8th (2043–2047)	195,000,000	838,487	0.43%
9th (2048–2050)	17,000,000	380,445	2.24%

19.8.20 As discussed in **Section 19.4**, the updated guidance from IEMA should be used when assessing the significance of GHG emissions from the Project. This takes into account the embedded mitigation, the wider benefits of the Project, the carbon emissions trajectory, and the policy alignment of the Project to gauge overall impact. As noted previously, it is down to the practitioner's professional judgement on how best to contextualise a project's GHG impact.

19.8.21 Furthermore, the greenhouse gas assessment includes the emission reductions achieved through the use of hydrogen as a replacement of fossil fuel energy sources and qualitatively considers the CO_2 capture and storage that could be enabled in the future by the Project.

19.8.22 For these reasons, and based on **Table 19-4**, it is assessed that the significance of operational GHG emissions is **beneficial** and **significant,** due to the GHG benefits of using hydrogen to displace fossil fuels. Further consideration was given to the potential future CO_2 sequestration contributing to UK's Net Zero trajectory.

19.8.23 The green hydrogen the Project is producing for distribution and use in the UK will contribute towards the UK achieving net zero emissions by 2050, by providing, for example, fuel for heavy transport vehicles including HGVs and buses, leading to operational savings of 704,634tCO_2 a year. Other potential applications for hydrogen are possible such as heavy industry and the end use would determine the net emissions and benefits achieved.

19.8.24 The emissions resulting from the operations would be significantly less than the avoided emissions of the Project (even ignoring the possibility of the reduction of the emissions themselves with implementation of appropriate mitigation as outlined in **Section 19.7**), noting the overall role the Project will play in reducing the UK carbon emissions.

19.8.25 Further use of the terminal for import of CO_2 for example will also contribute to the UK's net zero aims, as that CO_2 can be captured at source and fed into a carbon capture network for permanent storage. This is not quantifiable as a benefit at this stage but the expected capacity for additional imports of 9.8 million tonnes a year gives potential to enable large CO_2 sequestration.

Decommissioning

19.8.26 Decommissioning of the NSIP (the jetty) has been scoped out from this assessment. The Project does not make any provision for the decommissioning of the main elements of the marine infrastructure above and below water level. This is because the jetty, jetty head, loading platforms, access ramps and the jetty access road would, once constructed, become part of the fabric of the Port estate and would, in simple terms, continue to be maintained so that it can be used for port related activities to meet a long-term need. It is anticipated that plant and equipment on the jetty topside would be decommissioned in parallel with the decommissioning of the related landside elements.

19.8.27 While it is likely that some GHG emissions would arise as part of the decommissioning of the landside hydrogen production facilities, it is not possible to say with any certainty what they are likely to be. Methods of deconstruction and disposal are not known at this time.

19.8.28 It should also be noted that by the time the hydrogen production facilities are decommissioned, the UK is expected be achieving net zero emissions and therefore any impacts are likely to be reduced and considered immaterial compared with construction impacts.

CCR Assessment

19.8.29 As introduced in **Section 19.6**, baseline climate conditions have been identified. Construction and operation of the Project will potentially be subjected to adverse impacts from climate change before adaptation measures are introduced.

19.8.30 The assessment of potential climate events and the potential impacts on the Project are presented in **Appendix 19.B [TR030008/APP/6.4]**. These impacts on the Project are associated with:

a. Increased frequency and severity of extreme weather events.

b. Increased frequency and intensity of heavy precipitation events.

c. Increased summer temperatures.

d. Sea level rise.

Construction

19.8.31 During enabling works and construction, unless appropriate measures are applied, receptors such as the construction work force, construction plant, vehicles, materials and the construction programme may be vulnerable to a range of climate risks. These could include:

a. Extreme weather events (severe flooding, storms, snow, wind and ice) could impact the site's accessibility, restricting working hours and delaying the construction schedule.

b. Health and safety could be at risk during extreme weather events, potentially resulting in severe injury and/or death.

c. The higher peak temperatures and increased frequency and intensity of heatwaves, particularly in the summer, could create unsuitable working conditions for construction Project workers, plant, and equipment use.

d. Increased risk of extreme weather events could potentially damage construction materials, plant equipment, assets, and infrastructure.

Operation

19.8.32 During the operation, unless appropriate measures are applied, the Project may be vulnerable to a range of climate risks. These could include:

a. Extreme weather events could impact the Project's accessibility, restricting working hours and interrupting the operational schedule.

b. Operational workers' health and safety could be at risk, potentially resulting in severe injury and/or death from adverse weather.

c. The higher peak temperatures and increased frequency and intensity of heatwaves, particularly in the summer, could create unsuitable working conditions for operational site workers, plant and equipment use.

d. Increased risk of extreme weather events could potentially cause damage to land and marine based structures (e.g. jetties, buildings) and vehicles.

e. Extreme weather events could cause disruption to power and water services which may impact the operation of the Project.

f. The increased frequency of extreme weather events might increase the requirement for dredging and maintenance, leading to additional costs.

g. The increased risk in frequency and intensity of heatwaves could potentially result in damaging infrastructure and services through the increased risk of thermal expansion beyond the design tolerance of the materials.

h. Damage to drainage systems, gutters and downpipes due to flooding from intense rainfall.

i. Potential damage to equipment and infrastructure due to prolonged exposure to high intensity temperatures resulting in overheating of equipment/machinery.

ICCI Assessment

19.8.33 The ICCI assessment as presented in **Appendix 19.C [TR030008/APP/6.4]** has identified how the resilience of various receptors in the surrounding environment (such as local waterways or local heritage assets, etc.) are affected by the Project in combination with the future climatic conditions.

19.8.34 The impacts are assessed for the construction and operation of the Project. UKCP18 projections (Ref 19-19) for the geographical location and lifetime of the Project, and the receptors identified by technical specialists.

19.9 Mitigation and Enhancement Measures

Lifecycle GHG Impact Assessment

19.9.1 Whilst additional measures could be adopted to reduce the lifecycle GHG emissions, these are not included in the calculations or significance criteria assessment. These are given in **Appendix 19.A [TR030008/APP/6.4].**

CCR and ICCI Assessment

19.9.2 There are a range of additional measures that could help mitigate the effects of climate change on the development, listed in **Appendix 19.A [TR030008/APP/6.4]**. These are not considered as part of the assessment.

19.9.3 All new assets, structures and buildings would either be designed for projected climatic conditions, e.g. increased average temperatures using appropriate design guidance where available, or adaptive capacity will be built into the designs.

19.10 Assessment of Residual Effects

GHG Assessment

19.10.1 The assessment considers a project lifecycle approach with PAS2080 lifecycle stages set out in **Table 19-3**.

19.10.2 Following the updated IEMA guidance, all GHG emissions are classified as being significant because all emissions contribute to climate change. However, to contextualise the significance level, the GHG emissions from construction and operation of the Project were compared to the UK Carbon Budgets (**Table 19-19** and **Table 19-21** of this chapter). The effect of the emissions during construction is considered **minor adverse** and therefore **not significant**, while during the operational phase, it is considered **beneficial** due to the emissions saving from hydrogen, and the wider benefits of carbon sequestration.

19.10.3 As discussed in **Paragraphs 19.8.10** to **19.8.25** the Project will facilitate potential national emissions reductions through its contribution towards decarbonisation of UK industry including particularly heavy transportation from the use of hydrogen derived from green ammonia import. It is considered that any adverse effects of constructing and operating the Project will be outweighed by the carbon reduction benefits the Project will bring in its contribution to the UK achieving its net zero targets by 2050.

19.10.4 In line with IEMA guidance, the GHG assessment adopts a ‘worst-case' approach and does not take into account the UK’s Transport and Maritime Decarbonisation Plans, which aim for net zero by 2050. Hence, assuming these decarbonisation plans are successfully implemented, the Project will have a considerably smaller carbon footprint by 2050, as these emissions sources represent the majority of the Project’s GHG emissions.

CCR and ICCI Assessment

19.10.5 A number of climate resilience measures have been embedded within the design of the Project as set out in **Section 19.7**. As summarised in **Appendix 19.B**

[TR030008/APP/6.4], residual effects of climate impacts are considered **not significant.**

19.11 Summary of Assessment

GHG Assessment

19.11.1 IEMA criteria have been used to assess the significance of the impact of GHG emissions from the Project. The assessment concluded that the Project has a **beneficial** effect.

19.11.2 The Project's residual emissions will be outweighed by the savings of emissions resulting from the use of low carbon hydrogen energy produced by the Project which aligns with and will contribute to the UK net zero transition scenario.

19.11.3 The Project is anticipated to produce up to 300MW of hydrogen once fully operational at full capacity, the equivalent of up to 9.5 billion MJ per annum. Depending on market demand, it is estimated that this could meet up to 3% of Government's hydrogen production capacity target.

19.11.4 The hydrogen could be used in alternative ways such as displacing natural gas used in industrial processes, all of which are likely to result in similar or higher carbon savings. The ultimate carbon saving will depend on the fossil fuel being displaced. This would mean there is a **significant benefit** to the Project.

19.11.5 Additionally, whilst not taken into account in the assessment, potential use of the jetty for carbon dioxide imports and exports to facilitate carbon capture and storage will also assist the transition towards a net zero trajectory. One hundred and forty-two ships carrying 35,000 tonnes of CO_2 each (i.e. less than 3% of the total shipping assessed in this chapter), would suffice to sequester the overall emissions of the Project including the overall shipping over 25 years and construction of the Project.

CCR Assessment

Construction

19.11.6 A summary of the identified construction phase impacts, the adaptation methods to increase the resilience of the Project and likely effects of climate change on the Project is provided in **Appendix 19.B [TR030008/APP/6.4]**.

19.11.7 While the majority of impacts of climate change on the construction of the Project are considered to have a low to moderate impact prior to the inclusion of mitigation measures, following the addition of embedded and standard mitigation, all impacts from climate change on construction are considered to be **low** and **not significant**.

Operation

19.11.8 A summary of the identified operational phase impacts, the adaptation methods to increase the resilience of the Project and likely effects of climate change on the Project is provided in **Appendix 19.B [TR030008/APP/6.4]**.

19.11.9 While the majority of impacts of climate change on the operation of the Project are considered to have a low to moderate impact prior to the inclusion of mitigation measures, following the addition of mitigation, all impacts from climate change on operations are considered to be **low** and **not significant**.

ICCI Assessment

Construction

19.11.10 **Appendix 19.C [TR030008/APP/6.4]** provides a summary of the identified construction phase impacts and the adaptation methods to increase the resilience of receptors in the surrounding environment to the likely combined effects of climate change and the Project.

19.11.11 While the majority of impacts of climate change on receptors are considered to be low, following the mitigation and good practice measures embedded in the Project, no significant ICCIs have been identified.

Operation

19.11.12 **Appendix 19.C [TR030008/APP/6.4]** provides a summary of the identified operational phase impacts and the adaptation methods to increase the resilience of receptors in the surrounding environment to the likely combined effects of climate change and the Project.

19.11.13 While the majority of impacts of climate change on the receptors are considered to be low, following the mitigation and good practice measures embedded in the Project, no significant ICCIs have been identified.

19.12 References

Ref 19-1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

Ref 19-2 IEMA (2022). Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance.

Ref 19-3 IEMA (2020). Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation.

Ref 19-4 UK Government (2021). The Carbon Budget Order 2021.

Ref 19-5 UNFCCC (2016). Conference of the Parties, Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015.

Ref 19-6 Climate Change Act 2008.

Ref 19-7 Climate Change Committee (2020) The Sixth Carbon Budget - The UK's path to Net Zero.

Ref 19-8 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended by The Town and Country Planning and Infrastructure Planning (Environmental Impact Assessment) (Amendment) Regulations 2018).

Ref 19-9 Department for Transport (2012). National Policy Statement for Ports.

Ref 19-10 Ministry of Housing, Communities and Local Government (MHCLG) (2021). National Planning Policy Framework (NPPF).

Ref 19-11 MHCLG (2014, updated March 2019). National Planning Practice Guidance: Climate Change.

Ref 19-12 Department for Transport. (2021b). Decarbonising transport: a better, greener Britain.

Ref 19-13 North East Lincolnshire Council (2016). Environmental Policy Statement.

Ref 19-14 North East Lincolnshire (2021). Net Zero Carbon Roadmap.

Ref 19-15 North East Lincolnshire Council (2021). Natural Assets Plan.

Ref 19-16 Met Office (2020). Historic Climate Data.

Ref 19-17 Met Office (2018b). UKCP18 Guidance: Caveats and limitations.

Ref 19-18 ICE (2023). Guidance Document for PAS 2080.

Ref 19-19 Met Office (2018). UK Climate Projections (UKCP) 2018.

Ref 19-20 World Resources Institute (WRI) & World Business Council for Sustainable Development (WBCSD) (2004). The GHG Protocol: A Corporate Accounting and Reporting Standard.

Ref 19-21 Department for Energy Security and Net Zero (2023). Greenhouse gas reporting: conversion factors 2023.

Ref 19-22 ICE Database (2019). Embodied Carbon.

Ref 19-23 UNFCC (2015). Paris Agreement.

Ref 19-24 IPCC (2018). Global warming of 1.5°C - Special Report.

Ref 19-25 Committee on Climate Change (2017). UK Carbon Budgets.

Ref 19-26 Department for Business, Energy and Industrial Strategy, 2022. UK Low Carbon Hydrogen Standard, London: UK Government.

Ref 19-27 Department for Environment, Food and Rural Affairs, 2018. A Green Future: Our 25 Year Plan to Improve the Environment, London: UK Government

Ref 19-28 North East Lincolnshire Council (2018). Local Plan 2013 to 2032.

Ref 19-29 International Marine Organization (2023). 2023 IMO strategy on reduction of GHG emissions from ships.

Ref 19-30 Department for Transport, 2023. Renewable Transport Fuel Obligation: Compliance Guidance, London: UK Government.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 20: Materials and Waste

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 20: Materials and Waste

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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20 Materials and Waste

20.1 Introduction

20.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on materials and waste.

20.1.2 This chapter presents details of the baseline for material and waste relevant to the Project and sets out the study area. In addition, the chapter provides an overview of the assessment methodology being followed for the environmental assessment and applies that methodology, so as to identify the likely significant effects taking account of any standard and embedded mitigation, then considering additional mitigation to establish the residual effects of the Project.

20.1.3 This assessment follows the methodology as set out in the Institute of Environmental Management and Assessment's ("IEMA") guide to: "Materials and Waste in Environment Assessment, Guidance for a Proportionate Approach" (referred to herein as the "IEMA Guidance") (Ref 20-1).

20.1.4 For the purpose of this chapter of the Environmental Statement ("ES"), reference to materials and waste relates to:

a. The consumption of materials (key construction materials only namely steel, aggregates, asphalt and concrete; operational materials are excluded).

b. The generation and management of waste (excluding dredged materials which are not anticipated to be brought onshore).

20.1.5 Materials are defined in the IEMA Guidance as "physical resources that are used across the lifecycle of a development. Examples include key construction materials such as concrete, aggregate, asphalt and steel". Operational materials are scoped out of the assessment.

20.1.6 Other material assets considered include landfill void capacity and safeguarded mineral and waste sites. The Project Site is not in the vicinity of any safeguarded mineral sites and as such they are scoped out of this assessment.

20.1.7 Waste is defined as per the Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives ("Waste FD") (Ref 20-2) as "any substance or object which the holder discards or intends or is required to discard".

20.1.8 There are some interrelationships between potential effects on materials and waste and other disciplines. Therefore, reference should also be made to **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** for information on potential contaminated land that could give rise to waste requiring offsite waste management.

20.2 Consultation and Engagement

20.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the materials and waste assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on materials and waste. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**. Matters scoped out of this assessment are outlined in **Paragraph 20.4.3**.

20.2.2 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008. Associated British Ports ("The Applicant") prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

20.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May 2023 and 20 July 2023 in accordance with the Planning Act 2008 and a PEI Report Addendum was publicised to support the second Statutory Consultation.

20.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal Statutory Consultations and other pre-application engagement is summarised in **Table 20-1**. The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 20-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report assumes that waste arising from the extraction, processing and manufacture of construction components and products that would be used during the Project are being produced in manufacturing facilities with their own waste management plans, facilities, and supply chain (outside of the geographical scope of the assessment) and therefore seeks to scope this matter out of the assessment. The Inspectorate is content to scope this matter out on this basis.	The comment is noted.
		The Scoping Report states that other impacts associated with the management of waste (e.g. on water resources, air quality, noise or traffic resulting from the generation, handling, on-site temporary storage or off-site transport of materials and waste) are addressed separately in other relevant chapters of the ES and can therefore be scoped out of this aspect chapter. The Inspectorate agrees that this impact pathway should be considered separately in the other relevant chapters of the ES. The Materials and Waste aspect chapter should however cross reference to where this has been assessed elsewhere.	The comment is noted. This chapter includes cross references to other aspect chapters where appropriate.
		The Scoping Report seeks to scope out this matter as the project site is not in the vicinity of any safeguarded/ allocated mineral sites. The Inspectorate agrees that this matter can be scoped out due to the absence of this type of receptor in the development study area.	The comment is noted.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The Scoping Report seeks to scope out this matter as the project site is not in the vicinity of any Mineral Safeguarding Areas. The Inspectorate agrees that this matter can be scoped out due to the absence of this type of receptor in the development study area.	The comment is noted.
		The Scoping Report states that dredged materials would not be brought onshore for disposal and the effects associated would be addressed separately in other relevant chapters within the ES (**Chapter 8 Nature Conservation (Marine), Chapter 9 Ornithology, Chapter 11 Marine Transport and Navigation, Chapter 14 Historic Environment (Marine), Chapter 15 Physical Processes, Chapter 16 Marine Water and Sediment Quality**). On the basis that dredging arisals will not be disposed onshore, the Inspectorate considers that this matter is adequately addressed in the other aspect chapters and can therefore be scoped out of the materials and waste chapter.	The comment is noted. It is expected that the dredged materials would be disposed of at licensed sites within the estuary and are not anticipated to be brought onshore . A Waste Hierarchy Assessment ("WHA") which includes a more detailed consideration of the alternative options for the dredge material, is included as part of this ES (see **Appendix 2.A [TR030008/APP/6.4]**) concludes that the dredged material does not contain levels of contamination that would restrict the material being disposed of in the marine environment.
		The Scoping Report considers that any forecast effects (using professional judgement) on the availability of materials during operation would be negligible in relation	The comment is noted.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		to the scale and nature of the development. The Inspectorate agrees given the nature of the development operational materials use can be scoped out of the assessment.	
		The Scoping Report argues that it is not possible to assess waste and material resources effects of decommissioning, since waste infrastructure, technologies and good practices are likely to be substantially different to those currently in place. It states that an outline of the approach to decommissioning will be provided within the ES, which will detail measures envisaged to be implemented to avoid or reduce impacts during the decommissioning of the landside elements. Given the nature and scale of the development the Inspectorate agrees that this matter can be scoped out of the ES, however the ES must provide an estimate of the types of quantities of waste that would arise from decommissioning.	An **Outline Decommissioning Environmental Management Plan** ("DEMP") **[TR030008/APP/6.6]** has been produced and includes an estimate of the types and quantities of waste that would arise from decommissioning of the landside elements. A detailed DEMP will be secured via a Requirement of the Development Consent Order ("DCO"). In a worst-case scenario, where the Project elements would be fully removed, the potential risks during the decommissioning phase would be similar to those encountered during the Project construction phase as stated in **Section** 20.8 of this chapter. The DCO application does not make any provision for the decommissioning of the marine infrastructure;

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			however, plant and equipment on the jetty topside would be decommissioned and this is discussed further in **Chapter 2: The Project [TR030008/APP/6.2]**.
Scoping Report August 2022	Environment Agency	We are pleased to see the acknowledgement in paragraph 19.6.2 that any waste producers have a legal duty to manage their wastes in accordance with regulations: wastes produced or imported must be moved with due regard to the legal requirements for registered Waste Carriers under The Waste (England and Wales) Regulations 2011. If wastes are used for any construction, they must be stored at an appropriately permitted or exempt site, in accordance with the Environmental Permitting (England & Wales) Regulations 2016. Any direct transfer and reuse of clean naturally occurring soil materials between sites must be done in accordance with the Definition of Waste: Development Industry Code of Practice. Site drainage must be engineered to prevent pollution to the environment. Any potentially contaminated or contaminating liquids must be held and disposed of appropriately.	The reuse of excavated material would be covered by a Contaminated Land: Applications in Real Environments ("CL:AIRE") Definition of Waste: Development Industry Code of Practice ("DoW CoP") Materials Management Plan ("MMP") developed by the Contractor before the commencement of construction. Details of the requirements for the contractor are set out in an **Outline Construction Environmental Management Plan** ("Outline CEMP") which accompanies the DCO application **[TR030008/APP/6.5]**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
PEI Report January 2023	Polynt Composites	We note that the stated aim for delivery of the IGET Project is to 'minimise waste generation'. Further information as to how waste generation will be minimised during the construction phase. This is particularly important to Polynt as the Order Land will presumably be used for the storage of waste materials waiting removal from site.	As outlined in **Section 20.6**, the Project would aim to prioritise waste prevention, followed by preparing for reuse, recycling and recovery and lastly waste disposal to landfill as per the waste hierarchy. In addition, an **Outline Site Waste Management Plan** ("OSWMP") forms part of the **Outline CEMP**, which has been prepared and accompanies the DCO application **[TR030008/APP/6.5]**. The OSWMP has been developed to act as a guide to those involved in the construction of the Project on how to manage resources and waste, in accordance with best practice requirements. The Principal Contractor shall use this OSWMP as a framework for producing their own SWMP for use throughout the duration of construction.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
PEI Report January 2023	Environment Agency	Paragraphs 2.4.37 to 2.4.42 explain how the design of the project has evolved since the submission of the Scoping Report. The changes made on the landside of the project have resulted in an area of the Immingham Household Waste Centre now being included. This is a permitted waste site (Ref EAWML 73067/EPR/PP3192NP on Queens Road, Immingham, DN40 1QR – Grid Ref: TA20399 14765). We will require the Environmental Statement to explain what provision is being proposed to continue to allow access to, and protect the permitted area, during the construction and operation of the proposed development.	The Immingham Household Waste Centre is not included in the Site Boundary. Access to and operation of the Grimsby Operations Ltd, Household Waste Recycling Centre, Queens Road, Immingham is unaffected by the Project.
Second Statutory Consultation May 2023 – July 2023	Environment Agency	Change 1: Site Boundary Amendments We welcome the site boundary amendment, which now excludes the permitted Household Waste Site on Queens Road and resolves the issues we previously raised in paragraph 1.3 of our response to the original PEIR.	The Immingham Household Waste Centre is not included in the Site Boundary. Access to and operation of the Grimsby Operations Ltd, Household Waste Recycling Centre, Queens Road, Immingham is unaffected by the Project.

20.3 Legislation, Policy and Guidance

20.3.1 **Table 20-2** presents the legislation, policy and guidance relevant to the materials and waste assessment and details how their requirements will be met by the Project.

Table 20-2: Relevant legislation, policy and guidance regarding materials and waste

Legislation/Policy/Guidance	Consideration within this chapter
Waste Framework Directive (2008) (Ref 20-2)	
Establishes the wider regulatory context for waste management across Europe. In addition to defining waste, it also introduces the concept of the waste hierarchy and establishes landfill diversion targets for Member States. The requirements of the Waste Framework Directive are transposed into applicable national law through the *Waste (England and Wales) Regulations 2011* (Ref 20-3) as amended including via The Waste (Miscellaneous Amendments) (EU Exit) Regulations 2019 (Ref 20-4).	The assessment of materials and waste has taken account of the waste hierarchy in the management of waste (**Paragraph 20.7.4**), and of the targets for recovery of non-hazardous construction and demolition ("C&D") waste (**Paragraph 20.6.30**).
The Environmental Protection Act 1990 (Ref 20-5)	
The duty of care for waste management is set out under section 34 of the *Environmental Protection Act 1990* (Ref 20-5) and the *Waste (England and Wales) Regulations 2011 (as amended)* (Ref 20-3). It requires anyone who produces, imports, keeps, stores, transports, treats or disposes of waste to take all reasonable steps to ensure that waste is managed properly.	Details of the duty of care for waste management requirements for the contractor are set out in the OSWMP which forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]** and which the contractor's SWMP (to be prepared before the commencement of construction) must be in accordance with.
The Waste (England and Wales) Regulations 2011 (Ref 20-3)	
Transposes the requirements of the Waste Framework Directive in England and Wales and requires the Secretary of State (SoS) to establish waste prevention programmes and waste management plans that apply the waste hierarchy (as defined in the Waste Framework Directive). The waste hierarchy prioritises waste prevention, followed by preparing for reuse, recycling, recovery and finally disposal to the management of waste. The Regulations require businesses to apply the waste hierarchy when managing waste, and also require that measures are taken to ensure that, by the year 2020, at least 70% by weight of non-hazardous C&D waste is subjected to material recovery.	The assessment of materials and waste has taken account of the waste hierarchy (**Paragraph 20.7.4**) in the management of waste, and of the targets for recovery of non-hazardous C&D waste (**Paragraph 20.6.30**).

Legislation/Policy/Guidance	Consideration within this chapter
The Environmental Permitting (England and Wales) Regulations 2016 (Ref 20-6)	
The Regulations require sites where waste is processed, treated or disposed of to hold a valid Environmental Permit issued by the Environment Agency ("EA"). The Regulations also include a schedule of activities that are exempt from the requirements of permitting. However, to comply with the Regulations, an exempt activity must generally be registered with the EA before commencing.	Details of the permits and exemption requirements for the contractor are set out in the OSWMP which forms part of the **Outline CEMP** which accompanies the DCO application (**[TR030008/APP/6.5]**) and which the contractor's SWMP (to be prepared before the commencement of construction) must accord with.
The Hazardous Waste (England and Wales) Regulations 2005 (Ref 20-7)	
The Regulations set out the regime for the control and tracking of the movement of hazardous waste for the purpose of transposing the requirements of the *Hazardous Waste Directive (Directive 91/689/EC)* (Ref 20-8).	Details of the hazardous waste management requirements for the contractor are set out in the OSWMP which forms part of the **Outline CEMP** which accompanies the DCO application (**[TR030008/APP/6.5]**) and which the contractor's SWMP (to be prepared before the commencement of construction) must accord with.
The Environment Act 2021 (Ref 20-9)	
The Act makes provision about targets, plans and policies for improving the natural environment; for statements and reports about environmental protection; for the establishment of the Office for Environmental Protection; about waste and resource efficiency; about air quality; for the recall of products that fail to meet environmental standards; about water; about nature and biodiversity; for conservation covenants; about the regulation of chemicals; and for connected purposes. The Act will deliver: • An extension of producer responsibility to make producers pay for 100% of the cost of disposal of products, starting with plastic packaging. • A Deposit Return Scheme for single use drinks containers. • Charges for single use plastics. • Greater consistency in recycling collections in England. • Electronic waste tracking to monitor waste movements and tackle fly-tipping. • Further tackling of waste crime. • The power to introduce new resource efficiency information (labelling on the recyclability and durability of products).	Key sections including Part 3 Waste and Resource Efficiency (producer responsibility, resource efficiency, managing waste and waste enforcement) which could be relevant to the Project in the *Environment Act 2021* have been considered in **Section 20.7** and in the OSWMP which forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5] and** which the contractor's SWMP (to be prepared before the commencement of construction) must be in accordance with.

Legislation/Policy/Guidance	Consideration within this chapter
• The regulation of the shipment of hazardous waste. • A ban or export restriction of waste to non-OECD countries.	
National Policy Statement for Ports ("NPSfP") (Ref 20-10)	
Paragraph 5.5.2 of Section 5.5: Waste Management states *"Sustainable waste management is implemented through the 'waste hierarchy':* • *prevention;* • *preparing for re-use;* • *recycling;* • *other recovery, including energy recovery; and* • *disposal.* *Disposal of waste should only be considered where other waste management options are not available or where it is the best overall environmental outcome."*	The assessment of materials and waste has taken account of the waste hierarchy in the management of waste (**Paragraph 20.7.4**).
Paragraph 5.5.3 states *"All large infrastructure projects are likely to generate hazardous and non hazardous waste during the construction, operation and decommissioning phases. The Environment Agency's (EA) Environmental Permitting (EP) regime incorporates operational waste management requirements for certain activities. When an applicant applies to the EA for an Environmental Permit, the EA will require the application to demonstrate that processes are in place to meet all relevant EP requirements."*	Details of the permits and exemption requirements for the contractor are set out in the OSWMP which forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]** and which the contractor's SWMP (to be prepared before the commencement of construction) must accord with.
Paragraph 5.5.4 states *"The applicant should set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. The arrangements described and the Management Plan should include information on the proposed waste recovery and disposal system for all waste generated by the development and an assessment of the impact of the waste arising from development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation. The applicant should seek to minimise the volume of waste produced and the volume of waste sent for disposal, unless it can be demonstrated that this is the best overall environmental outcome."*	An OSWMP has been produced which forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]**, and which the contractor's SWMP (to be prepared before the commencement of construction) must accord with. The assessment considers the impact of the waste arising from the construction and operation of the Project on the capacity of waste management facilities, specifically landfills in **Section 20.8**. The approach to minimising waste for the Project is outlined in **Section** 20.7.

Legislation/Policy/Guidance	Consideration within this chapter
Paragraph 5.5.5 states *"The decision-maker should consider the extent to which the applicant has proposed an effective system for managing hazardous and non-hazardous waste arising from the construction, operation and decommissioning of the proposed development. It should be satisfied that:* • *any such waste will be properly managed, both on-site and off-site;* • *the waste from the proposed facility can be dealt with appropriately by the waste infrastructure which is, or is likely to be, available. Such waste arisings should not have an adverse effect on the capacity of existing waste management facilities to deal with other waste arisings in the area; and* • *adequate steps have been taken to minimise the volume of waste arisings, and of the volume of waste arisings sent to disposal, except where that is the best overall environmental outcome."*	An OSWMP forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]**, which the contractor's SWMP (to be prepared before the commencement of construction) must accord with. The assessment considers the impact of the waste arising from the construction and operation of the Project on the capacity of waste management facilities, specifically landfill (**Section** 20.8). The approach to minimising waste for the Project is outlined in **Section 20.7.**
National Planning Policy Framework ("NPPF") (Ref 20-11)	
The NPPF does not contain specific waste policies as these are detailed within the National Planning Policy for Waste (Ref 20-12) and Waste Management Plan for England (Ref 20-13), however, the following overarching policies are relevant to materials and waste: • The environmental objective set out at paragraph 8 of the NPPF is *"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."* • The environmental objective set out in paragraph 210 of the NPPF is to *"so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before considering extraction of primary materials, whilst aiming to source minerals supplies indigenously."*	The approach to minimising waste for the Project is outlined in **Section 20.7**. A recycled content target would be considered for inclusion in the contractor's SWMP included within the Final CEMP.

Legislation/Policy/Guidance	Consideration within this chapter
National Planning Policy Guidance ("NPPG") for Minerals (Ref 20-14) **and Waste** (Ref 20-15)	
Published to provide more in-depth guidance to the NPPF. The NPPG aims to make planning guidance more accessible and ensures that the guidance is kept up to date.	The guidance provides further information in support of the implementation of waste planning policy and on the planning for mineral extraction in plan making and the application process. This information has been taken into consideration when reviewing local policy but is not directly used in the assessment.
National Planning Policy for Waste (Ref 20-12)	
The National Planning Policy for Waste sets out detailed waste planning policies to be applied in conjunction with the NPPF. It states: "*when determining planning applications for non-waste development, local planning authorities should, to the extent appropriate to their responsibilities, ensure that:* • *The likely impact of proposed, non-waste related development on existing waste management facilities, and on sites and areas allocated for waste management, is acceptable and does not prejudice the implementation of the waste hierarchy and/or the efficient operation of such facilities;* • *New, non-waste development makes sufficient provision for waste management and promotes good design to secure the integration of waste management facilities with the rest of the development, and* • *The handling of waste arising from the construction and operation of development maximises reuse/recovery opportunities, and minimises off-site disposal*".	The likely impact of proposed, non-waste related development (the Project) on existing waste management facilities (specifically landfill) is considered in the assessment (**Paragraph 20.8.43** and **Paragraph 20.8.58**). Embedded mitigation measures include activities that would be undertaken during the design stage to minimise waste thus reducing the need for waste management and landfill disposal. These include the design of adequate provision for internal and external waste storage to allow waste segregation during Project operation (**Section 20.7**). The assessment of materials and waste has taken account of the waste hierarchy in the management of waste, and of the targets for recovery of non-hazardous construction and demolition waste. An OSWMP forms part of the **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]**, which the contractor's SWMP (to be prepared before the commencement of construction) must accord with.

Legislation/Policy/Guidance	Consideration within this chapter
The Waste Management Plan for England 2021 (Ref 20-13)	
Provides an overview of waste management in England and reiterates the requirement for all waste producers and waste management providers to implement the waste hierarchy. It also highlights the need for waste to be managed using the proximity principle and confirms England's commitment to recovering at least 70% by weight of non-hazardous C&D waste by 2020 (excluding soils and stones). Recovery is assumed in the context of this policy to include reuse, recycling and incineration with energy recovery.	The assessment of materials and waste has taken account of the waste hierarchy in the management of waste (**Paragraph 20.7.4**), and of the targets for recovery of non-hazardous C&D waste (**Paragraph 20.6.30**).
A Green Future: Our 25 Year Plan to Improve the Environment (Ref 20-16)	
The plan "*sets out goals for improving the environment within a generation and leaving it in a better state than we found it*". It details how the government will work with communities and businesses to do this. The following policies are relevant: • Make sure that resources are used more efficiently and kept in use for longer to minimise waste and reduce its environmental impacts by promoting reuse, remanufacturing and recycling. • Work towards eliminating all avoidable waste by 2050 and all avoidable plastic waste by end of 2042. • Reducing food supply chain emissions and waste. • Reducing litter and littering. • Improving management of residual waste.	Key policies relevant to the Project such as waste minimisation have been considered in **Section 20.7**. The approach to minimising waste for the Project is outlined in **Section 20.7**.
Our Waste, Our Resources, A Strategy for England (Ref 20-17)	
The Strategy will help the government to meet the commitments outlined in the 25 Year Plan and "*sets out how we will preserve our stock of material resources by minimising waste, promoting resource efficiency and moving towards a circular economy. At the same time we will minimise the damage caused to our natural environment by reducing and managing waste safely and carefully, and by tackling waste crime*." The strategy combines actions to be taken now and commitments for the coming years. Key targets and milestones and targets, which could be relevant to the Project, include: • Roll out of a deposit return scheme (subject to consultation) – 2023. • Legislation for mandatory separate food waste collections (subject to consultation) – 2023; • 75% recycling rate for packaging (subject to consultation) – 2023;	Key targets and milestones relevant to the Project such as how waste might need to be managed onsite (e.g. segregation) are considered in **Section 20.7**.

Legislation/Policy/Guidance	Consideration within this chapter
• 65% recycling rate for municipal solid waste – 2035. • Municipal waste to landfill 10% or less – 2035.	
North East Lincolnshire Local Plan 2013 to 2032 (Ref 20-18)	
Sets out the Council's approach to accommodating future requirements in relation to the demands on the Borough's mineral resource and waste needs. Relevant policies include: • Policy 44 – Safeguarding minerals and related infrastructure. • Policy 45 – Future mineral extraction and Secondary Aggregates. • Policy 47 – Future requirements for waste facilities. • Policy 48 – Safeguarding waste facilities and related infrastructure. • Policy 49 – Restoration and aftercare (waste). The Policy Map (Ref 20-19) shows the extent of Mineral Safeguarding Areas ("MSAs") for sand and gravel and blown sand and existing waste management facilities.	**Section 20.6** considers allocated / safeguarded mineral and waste sites in the vicinity of the Project. The Project Site is not in the vicinity of any safeguarded mineral sites and as such they are scoped out of this assessment.
IEMA Guidance (Ref 20-1)	
The document offers guidance and recommendations for EIA practitioners and stakeholders concerned with the impacts and effects of materials and waste on the environment. The guidance provides considerations for screening, scoping, consultation, assessment and subsequent reporting and monitoring.	The assessment has been completed in accordance with the IEMA Guidance as outlined in **Section 20.4**.
Contaminated Land: Applications in Real Environments ("CL:AIRE") Definition of Waste: Development Industry Code of Practice ("DoW CoP"), v2 (Ref 20-20)	
The DoW CoP provides a process which enables the reuse of excavated materials on-site or their movement between sites. Use of the DoW CoP supports the sustainable and cost-effective development of land. It can provide an alternative to Environmental Permits or Waste Exemptions.	The reuse of excavated material would be covered by a CL:AIRE DoW CoP Materials Management Plan ("MMP") developed by the Contractor before the commencement of construction. Details of the requirements for the Contractor are set out in an **Outline CEMP** which accompanies the DCO application **[TR030008/APP/6.5]**.

Legislation/Policy/Guidance	Consideration within this chapter
Waste and Resources Action Programme ("WRAP") Designing Out Waste: A Design Team Guide for Civil Engineering (Ref 20-21) **and Designing Out Waste: A Design Team Guide for Buildings** (Ref 20-22).	
The guides outline the case for taking action to designing out waste, provides a detailed explanation of the key principles that designers can use during the design process and how these principles can be applied to civil engineering and building projects to maximise opportunities to reduce construction waste and use materials more efficiently. It gives examples of technical solutions and how, in practice, designers have helped achieve significant waste reductions.	Designing out waste key principles have been considered and will continue to be considered during the design of the Project and are outlined in **Section 20.4.**

20.4 Assessment Methodology

20.4.1 The general approach for Environmental Impact Assessment ("EIA") provided in **Chapter 5: EIA Approach [TR030008/APP/6.2]** is not used for materials and waste since specific topic guidance and assessment criteria for materials and waste has been developed by IEMA (Ref 20-1) however the overarching approach is broadly in line.

20.4.2 Embedded measures are considered prior to the assessment of effects to avoid considering assessment scenarios that are unrealistic in practice i.e. do not take account of such measures even though they are standard practice (standard mitigation) and/ or form part of the Project design (embedded mitigation). Taking these measures into account means that realistic likely environmental effects are identified. Where likely significant adverse effects are identified after considering these embedded measures, Project specific mitigation measures are considered, developed and proposed, where necessary and possible.

Scope of the Assessment

20.4.3 Having regard to the information presented within the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**), the Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) has confirmed the Applicant's view that some materials and waste aspects are unlikely to generate significant effects and can thus be scoped out of consideration in this chapter as follows:

a. Waste arising from extraction, processing and manufacture of construction components and products.

b. Other environmental impacts associated with the management of waste from the Project which are assessed elsewhere in this Environmental Statement (on water resources (**Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**), air quality (**Chapter 6: Air Quality [TR030008/APP/6.2]**), noise (**Chapter 7: Noise and Vibration [TR030008/APP/6.2]**) or traffic (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**) resulting from the generation, handling, on-site temporary storage or off-site transport of materials and waste).

c. Direct impacts on safeguarded/allocated mineral sites.

d. Direct impacts on MSAs.

e. Materials arising from marine dredging (**Chapter 17: Marine Water and Sediment Quality, Chapter 16: Physical Processes [TR030008/APP/6.2]**) (unless material is not suitable for management in the estuary).

f. Effects on the availability of materials during operation.

g. Effects associated with decommissioning of the Project.

20.4.4 The assessment of materials and waste considers the following:

a. Waste producers have a legal duty of care to manage their waste in accordance with regulations and to ensure that any waste leaving the site where it is generated is transferred to a suitably licensed facility for further treatment or disposal.

b. Facilities transferring, treating or disposing of waste must be either licensed or apply for an exemption from a licence, and impacts arising from the operation of waste management facilities are considered as part of the planning and permitting process for these facilities themselves.

c. As part of their planning function, Waste Planning Authorities ("WPAs") are required to ensure that sufficient land is available to accommodate facilities for the treatment of all waste arising in the area, either within the WPA area, or through export to suitable facilities in other areas.

d. Mineral Planning Authorities ("MPAs") are required to ensure an adequate supply of minerals, sufficient to meet the needs of national and regional supply policies, and local development needs.

20.4.5 The sensitive receptors for the materials and waste assessment are:

a. Landfill void capacity in the expansive study areas of East Midlands and Yorkshire and the Humber (non-hazardous landfill void capacity) and England (hazardous landfill void capacity). As defined in the IEMA Guidance (Ref 20-1) "*landfill is a finite resource, and hence – through the ongoing disposal of waste – there is a continued need to expand existing and develop new facilities, this requires the depletion of natural and other resources which, in turn, adversely impacts the environment*."

b. Materials, national and regional consumption of key construction materials. As outlined in the IEMA Guidance (Ref 20-1) "*materials are, in their own right, sensitive receptors. Consuming materials impacts upon their immediate and (in the case of primary material) long-term availability; this results in the depletion of natural resources and adversely impacts the environment*."

c. Safeguarded/ allocated waste sites.

20.4.6 The IEMA Guidance (Ref 20-1) "does not consider waste processing and recovery facilities as sensitive receptors, rather: they are part of a system that has the potential to reduce the magnitude of adverse impacts associated with waste generation and disposal. Waste processing and recovery facilities are, hence, different to landfills, in that the latter are finite resources."

20.4.7 The materials and waste assessment entails the following:

Materials

a. Establishing the baseline for national and regional consumption of key materials (construction materials) by weight.

b. Assessing the sensitivity of materials as related to the availability and types of materials to be consumed by the Project during construction.

c. Establishing the quantities of key construction materials required for the construction of the Project.

d. Comparing the total quantities of key construction materials with the most recent national and regional demand (using a percentage approach).

e. Considering whether any allocated/safeguarded waste sites would be impacted by the Project.

Waste

a. Establishing the baseline landfill void capacity in the defined study areas.

b. Assessing the sensitivity of landfill void capacity.

c. Establishing the quantities of construction, demolition and excavation waste to be generated during the construction of the Project.

d. Comparing the total waste arising from the construction of the Project against the landfill void capacity (using a percentage approach).

Assessment Criteria

Sensitivity

20.4.8 The sensitivity of materials takes into account the availability and type of construction material to be consumed by the Project. The IEMA Guidance criteria described within **Table 20-3** have been used to determine the sensitivity of materials.

Table 20-3: Materials Receptors Sensitivity

Effects	Criteria for Materials Receptor Sensitivity
Negligible	On balance, the key materials required for the construction of the Project are forecast (through trend analysis and other information) to be free from known issues regarding supply and stock. *And/or* Are available, comprising a very high proportion of sustainable features and benefits compared to industry-standard materials.*
Low	On balance, the key materials required for the construction of the Project are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock. *And/or*

Effects	Criteria for Materials Receptor Sensitivity
	Are available, comprising a high proportion of sustainable features and benefits compared to industry-standard materials.
Medium	On balance, the key materials required for the construction of the Project are forecast (through trend analysis and other information) to suffer from some potential issues regarding supply and stock. *And/or* Are available, comprising some sustainable features and benefits compared to industry-standard materials.
High	On balance, the key materials required for the construction of the Project are forecast (through trend analysis and other information) to suffer from known issues regarding supply and stock. *And/or* Comprise little or no sustainable features and benefits compared to industry-standard materials.
Very High	On balance, the key materials required for the construction of the Project are forecast are known to be insufficient in terms of production, supply and/ or stock. *And/ or* Comprise no sustainable features and benefits compared to industry-standard materials.
* Subject to supporting evidence, sustainable features and benefits could include, for example, materials or products that: comprise reused, secondary or recycled content (including excavated and other arisings); support the drive to a circular economy; or in some other way reduce lifetime environmental impacts.	

20.4.9 The sensitivity of waste relates to the availability of landfill capacity in the absence of the Project. As outlined in the IEMA Guidance "*landfill capacity is recognised as an unsustainable and increasingly scarce option for managing waste*". The sensitivity of landfill capacity has been assessed based on a review of historic landfill void capacity trends where available and information from relevant policy documents.

20.4.10 The criteria described within **Table 20-4** and **Table 20-5** have been used to determine the sensitivity of landfill capacity.

Table 20-4: Inert and Non-hazardous Landfill Capacity Sensitivity

Effects	Criteria for Inert and Non-hazardous Landfill Capacity Sensitivity
Negligible	Across construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional inert and non-hazardous landfill capacity expected to remain unchanged, or is expected to increase through a committed change in capacity.

Effects	Criteria for Inert and Non-hazardous Landfill Capacity Sensitivity
Low	Across construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional inert and non-hazardous landfill capacity is expected to reduce minimally by <1% as a result of wastes forecast.
Medium	Across construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional inert and non-hazardous landfill capacity is: expected to reduce noticeably by 1-5% as a result of wastes forecast.
High	Across construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional inert and non-hazardous landfill capacity is: expected to reduce considerably: by 6-10% as a result of wastes forecast.
Very High	Across construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional inert and non-hazardous landfill capacity is: • Expected to reduce very considerably (by >10%). • End during construction or operation. • Is already known to be unavailable. • Would require new capacity or infrastructure to be put in place to meet forecast demand.

Table 20-5: Hazardous Landfill Capacity Sensitivity

Effects	Criteria for Hazardous Landfill Capacity Sensitivity
Negligible	Across the construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional (or where justified, national) hazardous landfill capacity is expected to remain unchanged, or is expected to increase through a committed change in capacity.
Low	Across the construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional (or where justified, national) hazardous landfill capacity is expected to reduce minimally: by <0.1% as a result of wastes forecast.
Medium	Across the construction and or operational phases, the baseline/future baseline (i.e. without the Project) of regional (or where justified, national) hazardous landfill capacity is: expected to reduce noticeably: by 0.1-0.5% as a result of wastes forecast.
High	Across the construction and/or operational phases, the baseline/future baseline (i.e. without the Project) of regional (or where justified, national) hazardous landfill capacity is expected to reduce considerably: by >0.5-1% as a result of wastes forecast.
Very High	Across the construction and/or operational phases, the baseline/ future baseline (i.e. without the Project) of regional (or where justified, national) hazardous landfill capacity is: • Expected to reduce very considerably (by >1%).

Effects	Criteria for Hazardous Landfill Capacity Sensitivity
	• End during construction or operation. • Is already known to be unavailable. • Would require new capacity or infrastructure to be put in place to meet forecast demand.

Magnitude

20.4.11 The magnitude of impact describes the degree of variation from the baseline conditions as result of the Project. The methodology for assessing the magnitude of impact associated with materials comprises a percentage-based approach that determines the influence of construction materials used during the construction of the Project on the baseline national and regional demand. The criteria used to assess the magnitude of impact for materials are provided within **Table 20-6**.

Table 20-6: Materials Magnitude of Impacts

Effects	Criteria for Materials Magnitude of Impacts
No change	Consumption of no materials is required.
Negligible	Consumption of no individual material type is equal to or greater than 1% by volume of the regional* baseline availability.
Minor	Consumption of one or more materials is between 1-5% by volume of the regional* baseline availability.
Moderate	Consumption of one or more materials is between 6-10% by volume of the regional* baseline availability.
Major	Consumption of one or more materials is >10% by volume of the regional* baseline availability.
**A national baseline is used for steel in the absence of regional consumption data.*	

20.4.12 The methodology for assessing the magnitude of impact for waste comprises a percentage-based approach that determines the influence of waste generation from the construction of the Project on the baseline landfill capacity. The criteria used to assess the magnitude of impact for waste are provided within **Table 20-7** and **Table 20-8** for inert and non-hazardous waste and hazardous waste respectively.

Table 20-7: Inert and Non-Hazardous Waste - Magnitude of Impact

Effects	Criteria for Waste Magnitude of Impacts
No change	Zero waste generation and disposal from the Project.
Negligible	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by <1%.
Minor	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by 1-5%.
Moderate	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by 6-10%.
Major	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by >10%.
# Forecast as the worst-case scenario, during a defined construction and/ or operational phase.	

Table 20-8: Hazardous Waste - Magnitude of Impact

Effects	Criteria for Waste Magnitude of Impacts
No change	Zero waste generation and disposal from the Project.
Negligible	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by <0.1%.
Minor	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by <0.1-0.5%.
Moderate	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by >0.5-1%.
Major	Waste generated by the Project would reduce expansive study area landfill capacity baseline# by >1%.
# Forecast as the worst-case scenario, during a defined construction and/ or operational phase.	

Significance

20.4.13 **Table 20-9** describes the effect thresholds used to determine the significance of potential materials and waste effects (taking into account receptor sensitivity and the magnitude of impact), whilst **Table 20-10** shows that effects assessed as being moderate, large or very large are deemed to be significant. Where an effect is between two effect thresholds, professional judgement has been applied (for example between Slight and Moderate).

Table 20-9: Effect Thresholds

		Magnitude of Impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity of Receptor	**Very High**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Table 20-10: Significance of Effect

Effect	**Materials**	**Waste**
Neutral	Not significant	Not significant
Slight		
Moderate	Significant	Significant
Large		
Very large		

Limitations and Assumptions

20.4.14 The information presented in this assessment reflects that obtained and evaluated at the time of reporting, and is based on the proposed parameters for the Project and the maximum identified extents of land required for its construction and operation in accordance with the principles of the Rochdale Envelope approach.

20.5 Study Area

20.5.1 The study areas for the assessment of impacts related to materials and waste have been defined in line with the IEMA Guidance. Two types of study area are defined in the IEMA Guidance, namely a 'Project Study Area' relevant to waste generation, material use and impacts on allocated/ safeguarded sites; and an 'Expansive Study Area' relevant to management of waste and the availability of materials. Within this section, study areas are defined for the following:

a. Construction and operational waste generation.

b. Use of construction materials (key construction materials only - steel, aggregates, asphalt and concrete).

c. Impact on allocated/safeguarded mineral and waste sites.

d. Presence of MSAs.

e. Non-hazardous, inert and hazardous construction waste management.

f. Non-hazardous, inert and hazardous operational waste management.

g. Availability of key construction materials.

Project Study Area

20.5.2 The Project study area for construction and operational waste generation and the use of construction and materials (key construction materials only) comprises the Site Boundary (Order Limits as presented in **Figure 2.1: Application Site Boundary [TR030008/APP/6.3]**). The study area includes the footprint of the proposed works, together with any temporary land requirements during construction which may include temporary offices, compounds and storage areas.

20.5.3 The Project study area for the impacts on allocated/ safeguard mineral and waste sites is defined by the Site Boundary. Impacts on allocated/ safeguarded waste sites which are not included in the IEMA Guidance are included in this assessment for completeness.

20.5.4 Impacts on MSAs are not assessed in the materials and waste assessment in accordance with the IEMA Guidance. However, MSAs are included for context in the baseline since MSAs are a planning consideration.

Expansive Study Area

20.5.5 The expansive study area for non-hazardous waste management (construction and operation) comprises the East Midlands and Yorkshire and the Humber. The expansive study area includes the following sub-regions as outlined in the *EA's 2021 Waste Summary Tables for England* - Version 2 (Ref 20-23):

a. Lincolnshire, Derbyshire, Leicestershire, Northamptonshire and Nottinghamshire.

b. Former Humberside, North Yorkshire, South Yorkshire, West Yorkshire.

20.5.6 The expansive study area for non-hazardous and inert waste management is defined based on professional judgement and informed by consideration of the proximity principle and value for money. The study area has been determined to comprise the wider region within which landfill capacity is located i.e. East Midlands region and the Yorkshire and the Humber region since the Project is located close to the northern border of the East Midlands and waste could be managed in either region.

20.5.7 The expansive study area for hazardous waste management (construction and operation) is England. The expansive study area is defined based on professional judgement and informed by consideration of the proximity principle and value for money. The proximity principle for hazardous waste in England is outlined in Principle 2 - Infrastructure Provision in the Strategy for Hazardous Waste Management in England "*We look to the market for the development of hazardous waste infrastructure, which implements the hierarchy for the management of hazardous waste and meets the needs of the UK to ensure that the country as a whole is self-sufficient in hazardous waste disposal, facilities are put in place for hazardous waste recovery in England, and the proximity principle is met*" (Ref 20-24). Planning for hazardous waste management is also undertaken at a national level.

20.5.8 The expansive study area for availability of key construction materials (aggregates, asphalt, concrete and steel) covers the United Kingdom ("UK") or Great Britain ("GB") or East Midlands region and the Yorkshire and the Humber region dependent on baseline information availability. Regional information on the availability of key construction materials is included in the baseline where available.

20.6 Baseline Conditions

Regional and National Availability of Key Construction Materials

Current Baseline

20.6.1 UK and GB data and regional data has been used to establish a quantitative national baseline of the consumption for key constructional materials. **Table 20-11** summarises national consumption in 2018 for aggregates, asphalt, concrete and steel (the most recent year for which data is available), which are the key construction materials expected to be used during the construction of the Project.

Table 20-11: National Consumption for Key Construction Materials

Material	National Consumption (million tonnes, year)	Baseline Data Year	Data Description
Steel	17	2018	UK total consumption (Ref 20-25)
Aggregates **of which:**	251	2018	Minerals and mineral products sales in GB (Ref 20-26)
• Crushed rock	117.3		
• Sand and gravel - land won	48.9		
• Sand and gravel - marine	13.7		
• Recycled and secondary	71		
Asphalt	25.4		
Concrete **of which:**	86.2		
• Ready-Mixed Concrete	54.2		
• Concrete products	32		

20.6.2 Construction material sales data by region are provided for the regions surrounding the Project in **Table 20-12**. It is assumed that the majority of key construction materials (e.g. aggregates, asphalt and concrete) required for the Project would be sourced regionally, taking into account the proximity principle and value for money. Other materials such as steel may be sourced at a national level.

Table 20-12: Construction Material Sales by Region 2018 (Ref 20-26)

Construction Material	East Midlands	Yorkshire and the Humber
Crushed rock (million tonnes)	26.5	11.5
Sand and gravel (million tonnes)	6.1	2.3
Ready-mixed concrete (million m^3)	1.4	1.2
Asphalt (million tonnes)	2.8	2.1

20.6.3 Potential recycled contents for the main construction materials likely to be used during Project construction are outlined in **Table 20-13**. These "good practice" rates are derived from WRAP's Designing Out Waste Tool for Civil Engineering (Ref 20-27).

Table 20-13: Potential Recycled Content

Material Type	Potential Recycled Content (% by weight)
Concrete	16
Asphalt	25
Aggregates	50
Steel reinforcement	100
Structural steel	60

Future Baseline

20.6.4 There is no publicly available information on any potential long-term changes to national material demands by the time of construction of the Project. Construction material demand such as ready mixed concrete is closely aligned to both the quantity of construction taking place and the general economy. Therefore, it is deemed inappropriate to forecast future demand as it is unlikely to be linear. It is, therefore, not possible to set a future baseline for materials. As such, the future baseline is assumed during Project construction to be the same as the current baseline as outlined in **Table 20-11**.

Allocated/Safeguarded Mineral and Waste Sites and MSAs

20.6.5 As outlined in the North East Lincolnshire Local Plan 2013 to 2032 (adopted 2018) (Ref 20-18) "*the area features some mineral deposits of economic importance, however, no primary extraction occurs in the Borough"*. However, *"significant existing and planned infrastructure identified on the Policies Map, that supports the supply of minerals in the Borough would be safeguarded against development that would unnecessarily sterilise or prejudice its use, including development of incompatible land uses nearby. This includes strategic rail freight links, sites for concrete batching, manufacture of coated materials and concrete products, and sites associated with the handling, processing, and distribution of substitute, recycled and secondary aggregate material."*

20.6.6 There are no active mineral extraction "*sites in North East Lincolnshire contributing to primary aggregate production and the Council's call for sites has not identified any potential minerals sites.* (Ref 20-18)*"* Therefore, there are no allocated/ safeguarded mineral sites within the Site.

20.6.7 Three sites producing secondary and recycled aggregates are listed in the North East Lincolnshire Local Plan: these sites are not within close proximity (over 1km) from the Site. There are no concrete batching/aggregate sites within close proximity of the Site as outlined on the MSA and Waste Sites Policy Map (Ref 20-19).

20.6.8 North East Lincolnshire Council safeguards the existing waste management facilities identified on the Policies Map (Minerals and Waste) "*from the encroachment of incompatible development unless the planning permission has expired and/ or it can be demonstrated that the site is no longer required. The Council would seek to ensure that new development in proximity to a waste site is not incompatible with the waste management facility and would not prejudice its ongoing operation*". The details of waste sites adjacent or within the Site are presented in **Table 20-14**.

Table 20-14: Safeguarded Waste Sites Adjacent to the Project

North East Lincolnshire Local Plan reference	Operator	Site Location	Details
WM05	Grimsby Operations Ltd	Household Waste Recycling Centre, Queens Road, Immingham	Access to and operation of the Grimsby Operations Ltd, Household Waste Recycling Centre, Queens Road, Immingham is unaffected by the Project. Access to the site will be maintained at all times.
WM07	Integrated Waste Management Ltd	Queens Road, Immingham	Access road to the permitted landfill is within the Site Boundary however operational access to the landfill will be maintained at all times.

20.6.9 Three other safeguarded waste sites are located within 1km of the Site as presented in **Table 20-15**.

Table 20-15: Other Safeguarded Waste Sites Within 1km of the Project

North East Lincolnshire Local Plan Reference	Operator	Site Location
WM03	Associated British Ports	Immingham Dock Olive Residue Storage

North East Lincolnshire Local Plan Reference	Operator	Site Location
WM08	Selvic Shipping Services Ltd and FBM Metals (UK) Ltd (licence name F B M Metals (UK) Ltd and F B M Holdings Ltd	Kiln Lane Treatment Plant, Netherlands Way, Stallingborough
WM09	SJP Trading Ltd (licence name Stokesley Metals Ltd)	Huckers Yard, Netherlands Way, Stallingborough

20.6.10 North East Lincolnshire Council has designated MSAs for sand and gravel and blown sand, however these areas are not located within close proximity of the Site (in the Stallingborough area and Habrough area over 4km away).

Landfill Capacity

Current Baseline

20.6.11 **Table 20-16** presents remaining landfill capacity at the end of 2021 as outlined on the EA's 2021 Waste Summary Tables for England – Version 3 (last updated 30 September 2022) (Ref 20-23) for the non-hazardous and inert waste expansive study area (East Midlands and Yorkshire and the Humber) and the hazardous waste study area (England).

20.6.12 Merchant landfills are operated for commercial purposes accepting waste from construction projects and operating businesses. Merchant landfills are therefore considered to form the baseline. In contrast, restricted landfills are sites that deal with their own produced waste (i.e. not operating for commercial purposes) and therefore additional capacity associated with such facilities is excluded from the baseline. Some non-hazardous landfills have a Stable Non-Reactive Hazardous Waste Cell ("SNRHW") e.g. for asbestos.

Table 20-16: Landfill Capacity (2021) in East Midlands, Yorkshire and The Humber, and England

Landfill Type	Sub-Region			
	East Midlands	Yorkshire and the Humber	Total in East Midlands and Yorkshire and the Humber	England
	Capacity ('000s m^3)			
Hazardous Merchant	800	700	1,500	12,107
Non-hazardous with SNRHW cell	15,884	1,243	17,127	52,006
Non-hazardous	17,570	45,196	62,766	162,369

Landfill Type	Sub-Region			
	East Midlands	Yorkshire and the Humber	Total in East Midlands and Yorkshire and the Humber	England
	Capacity ('000s m^3)			
Inert	21,574	25,283	46,857	129,078
Sub-total (non-hazardous and inert)	55,028	71,722	126,750	343,453

20.6.13 **Table 20-16** indicates that total non-hazardous and inert landfill capacity in the non-hazardous study area is 127 million m^3. Total hazardous landfill capacity in the hazardous waste study area is 12.1 million m^3.

Future Baseline

20.6.14 The EA has published landfill capacity trends for 2004 to 2021 in 2022 within the EA's 2021 Waste Summary Tables for England – Version 3 (last updated 13 January 2022) (Ref 20-23).

20.6.15 **Plate 20-1** presents the historic trend for the remaining landfill capacity for the East Midlands and Yorkshire and the Humber.

20.6.16 **Plate 20-2** presents the historic trend for remaining landfill capacity for England.

20.6.17 Collated data is only available for "Inert" (inert landfill only) and "Non-Inert" (non-hazardous landfill sites, non-hazardous landfill sites with a SNHRW cell and merchant hazardous landfill sites) therefore the categories do not align with the 2021 landfill capacity data which is split by hazardous, non-hazardous and inert as shown in **Table 20-16**.

Plate 20-1: Historic Trend for Landfill Void Capacity in East Midlands and Yorkshire and the Humber (Ref 20-23)

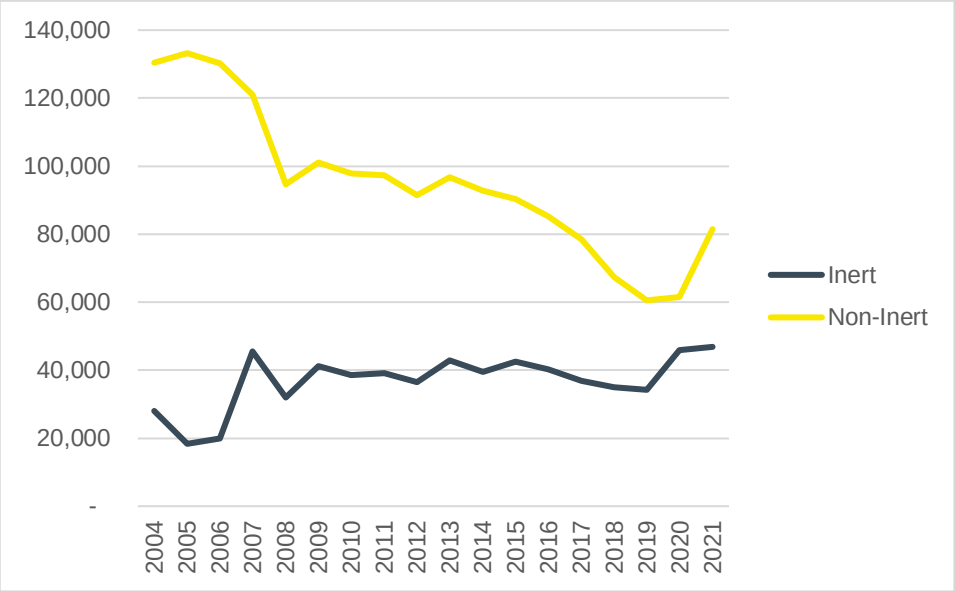
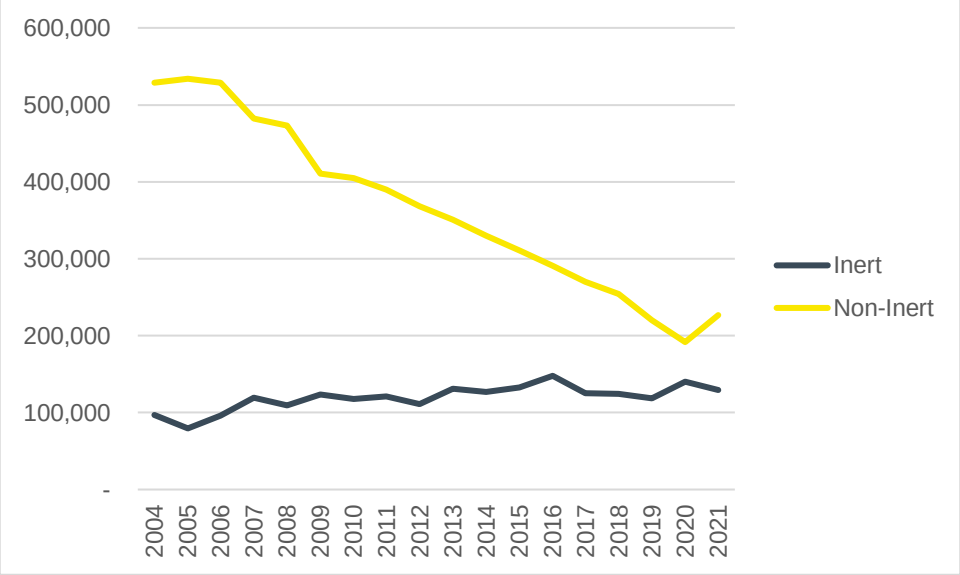


Plate 20-2: Historic Trend for Landfill Void Capacity in England (Ref 20-23)



20.6.18 There is no publicly available information on any potential changes to landfill capacity by the time of Project construction in early 2025. Due to the cyclic nature of inert landfill capacity, it is not realistic to forecast future landfill capacity since this may result in an increase in landfill capacity. Therefore, future inert landfill capacity during Project construction is assumed to be the same as the current baseline as outlined in **Table 20-16**.

20.6.19 For non-inert landfill (which includes hazardous waste) capacity using the current rate of decline of landfill capacity and forecasting into the future would lead to the inevitable conclusion that there would be no void space remaining. However, this is not a credible scenario as if there is still a need for landfill, then the WPA would need to consent new landfill capacity to replace that which has been used up. Therefore, future non-hazardous and hazardous landfill capacity during Project construction (see **Chapter 2: The Project [TR030008/APP/6.2]** for details of construction phasing) is assumed to be the same as the current baseline as outlined in **Table 20-16**.

Waste Management Infrastructure

20.6.20 The permitted capacity of other types of waste infrastructure is publicly available (e.g. Environmental Permitting Regulations - Waste Sites (Ref 20-28)), however, the permitted capacity is not necessarily representative of the actual operational capacity of the infrastructure since waste inputs may not be as high as permitted capacity. Therefore, inputs data are collated from the EA's Waste Data Interrogator 2021 – Waste Received (Excel) – Version 2 (Ref 20-29) and presented in **Table 20-17**.

20.6.21 Inputs are not totalled since the double counting of waste in the Waste Data Interrogator cannot be discounted. Double counting results from the same waste making multiple movements through multiple facilities e.g., transfer station to treatment facility with residues going to an energy from waste plant.

Table 20-17: Summary of Waste Inputs by Facility Type 2021 (Ref 20-29)

Facility Type	East Midlands (tonnes received)	Yorkshire and the Humber (tonnes received)
Landfill	4,238,163	4,501,192
MRS (Metal Recycling)	843,958	1,817,180
On/In Land	551,542	1,397,745
Transfer	4,588,886	5,394,163
Treatment	7,389,323	14,703,527
Combustion	72,986	71,810
Incineration	1,006,895	2,908,832
Mining	4,575	752
Storage	146,905	315,692
Processing	185,618	534,065

20.6.22 The IEMA Guidance *"does not consider waste processing and recovery facilities as sensitive receptors, rather: they are part of a system that has the potential to reduce the magnitude of adverse impacts associated with waste generation and disposal. Waste processing and recovery facilities are, hence, different to landfills, in that the latter are finite resources."* Therefore, a full list of waste management infrastructure is not included in the baseline as presented herein.

20.6.23 Since some of the operational hazardous wastes likely to be generated by the Project will not be suitable for landfill disposal e.g. liquid waste, hazardous operational waste is compared to national hazardous waste management facility capacity in this assessment.

20.6.24 Due to the specialised nature of hazardous waste management, hazardous waste facilities typically receive wastes from a wide region, and therefore this assessment considers the national capacity for managing hazardous wastes.

20.6.25 There are a number of high-temperature hazardous waste incinerators in England (excluding facilities which manage only clinical waste and received less than 500 tonnes).These facilities as reported EA's Waste Data Interrogator 2021 – Waste Received (Excel) – Version 2 (Ref 20-29) and are shown in **Table 20-18**.

Table 20-18 Hazardous Waste Incineration Facilities

Facility	Location	2021 Waste Received (Tonnes of Hazardous Waste Received)
Hazardous Waste Incinerators		
Avonmouth Treatment Centre	Bristol	6,318
East Kent Waste Recovery Facility	Kent	4,615
Ellesmere Port Incinerator	Cheshire	56,488
Fawley HT Incinerator	Hampshire	30,287
Kirk Sandall Thermal Treatment Plant	Doncaster	5,304
Fine Environmental Services – Seal Sands	Tees Valley	19,018
Twinwoods Co-incinerator	Bedford	3,583
Total		**125,613**

20.6.26 The EA's Waste Data Interrogator 2021 – Waste Received (Excel) – Version 2 (Ref 20-29) shows the following quantities (**Table 20-19**) of liquid hazardous waste were treated by permitted facilities in England (excluding waste in European Waste Catalogue ("EWC") Code Chapter 13 "Oil Wastes and Wastes of Liquid Fuels"). In how these inputs are totalled, however, double counting of waste in the Waste Data Interrogator cannot be discounted.

Table 20-19 Hazardous Liquid Waste Treatment Facilities in England

Facility Permit Type	2021 Waste Received (Tonnes)
T05: Physico-chemical treatment installation	290,279
T06: Chemical treatment installation	143,314
T10: Haz waste treatment installation	178,591
T11: Haz waste transfer/treatment installation	32,651
Total	**644,836**

Historic Landfills

20.6.27 Historic landfills are potentially relevant to this assessment since excavations in historic landfill can give rise to waste that would require appropriate management. The Environment Agency's Historic Landfill Sites spatial data (Ref 20-30) does not present any historic landfills in close proximity to the Project Site. The dataset includes sites that existed before landfills were regulated. Much of this pre-licensing data was derived from a national survey in the early 1990s so it may be incomplete.

20.6.28 There is one historic landfill 100m to the north of the Project on the northern side of the railway line (i.e. Dock South East, Immingham). First waste inputs to the landfill occurred in 1986, whilst the licence was surrendered in 1990. The landfill was licensed to accept inert and industrial waste.

20.6.29 **Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2]** provides information on a landfill that is not listed in the Environment Agency's Historic Landfill Sites spatial data (Ref 20-30). This is a mid- 20th century landfill site, Immingham H.C.C Landfill (MNL1063) and is recorded on the southern edge of the West Site, the very northern extent of this asset overlapping with the southern boundary of West Site. The extent of the landfill is visible today as a series of earthworks and "scars". A small part of the landfill is located within the Site Boundary, however the asset itself would be entirely unaffected by the Project.

Targets

20.6.30 The national target for recovery of C&D waste is 70% by weight, as set out in the Waste FD and the Waste Management Plan for England (Ref 20-13). The target specifically excludes naturally occurring materials with EWC Code 17 05 04 (soil and stones other than those mentioned in 17 05 03* (soils and stones containing dangerous substances)). Recovery is deemed to include reuse, recycling and other recovery e.g. energy recovery.

20.6.31 A good practice landfill diversion target of 90% has been achieved and exceeded by major UK developments as outlined in the IEMA Guidance. In 2018, the UK generated 67.8 million tonnes of non-hazardous C&D waste, of which 62.6 million tonnes was recovered. This represents a recovery rate of 92.3% (Ref 20-31).

20.6.32 Standard, good and best practice recovery rates by material are provided by Waste & Resources Action Programme ("WRAP") (Ref 20-32). Recovery rates for key construction materials and other construction wastes relevant to the Project construction phase are provided in **Table 20-20**.

Table 20-20: Standard, Good and Best Practice Recovery Rates by Material

Material	Standard Practice Recovery (%)	Good Practice Recovery (%)	Best Practice Recovery (%)
Metals	95	100	100
Packaging	60	85	95
Concrete	75	95	100
Inert	75	95	100
Plastics	60	80	95
Miscellaneous	12	50	75
Electrical equipment	Limited information	70	95
Cement	Limited information	75	95
Liquids and oils	100	100	100
Hazardous	50	Limited information, cannot be 100% since some hazardous waste e.g. asbestos must be landfilled.	

Receptor Sensitivity

20.6.33 Materials required for Project construction are determined to be receptors of 'low' sensitivity. On balance, the key materials required for the construction of the Project are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock. Key materials required for the construction are likely to be available comprising a high proportion of sustainable features and benefits (e.g. recycled content).

20.6.34 Potential recycled content for the main Project construction materials are outlined in **Table 20-13**.

20.6.35 Waste receptors of relevance to the Project are determined to have a 'very high' sensitivity. Since there is no publicly available information on any potential changes to landfill capacity by the time of the Project construction and operation, a worst-case scenario has been considered.

20.6.36 It is assumed that (without the Project) non-hazardous landfill void capacity in the expansive study area is expected to:

a. Reduce very considerably (by >10%).
b. End during Project construction and operation.
c. Is already known to be unavailable.
d. Would require new capacity or infrastructure to be put in place to meet forecast demand.

20.6.37 It is assumed that (without the Project) hazardous landfill void capacity in the expansive study area is expected to:

a. Reduce very considerably (by >1%).
b. End during Project construction and operation.
c. Is already known to be unavailable.
d. Would require new capacity or infrastructure to be put in place to meet forecast demand.

20.7 Development Design and Impact Avoidance

Embedded Mitigation

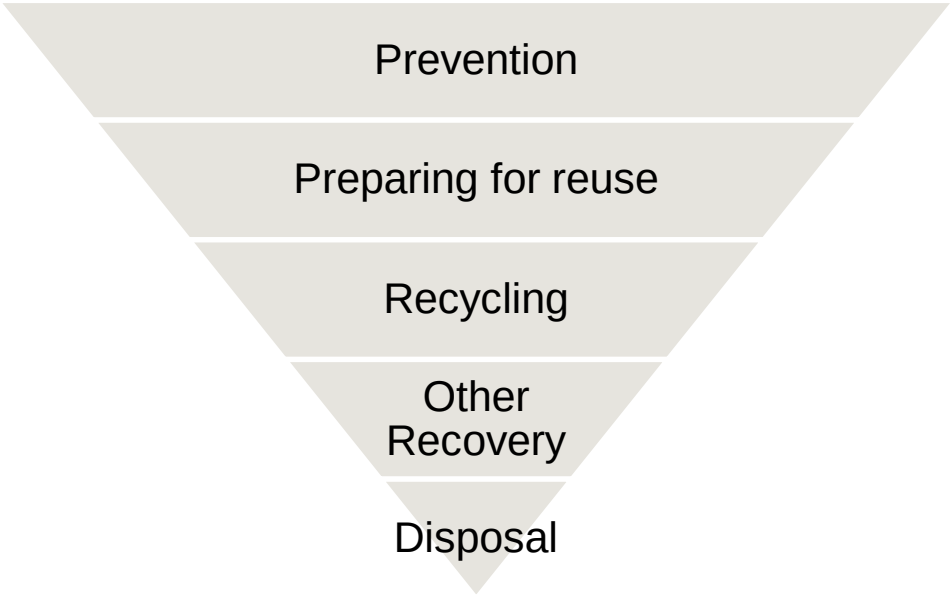
20.7.1 As described in the IEMA Guidance, embedded (primary) mitigation is the prevention or reduction of adverse effects through the resource-efficient design, construction and/or lifetime operation of a project.

20.7.2 Primary mitigation measures are an intrinsic part of the Project, and do not require additional action to be taken. Such measures are often identified as a result of the interaction between the environmental and engineering specialists within a project team, who are able to identify and agree by consensus resource-efficient design solutions.

20.7.3 Embedded mitigation measures of relevance to materials and waste for the Project are described below.

20.7.4 The Project will aim to prioritise waste prevention, followed by preparing for re-use, recycling and recovery and lastly waste disposal to landfill as per the waste hierarchy as detailed in **Plate 20-3**.

Plate 20-3: The Waste Hierarchy (Ref 20-35)



20.7.5 The following designing out waste mitigation measures will be implemented during the Project design and subsequent construction phase and are included in the OSWMP which is appended to the **Outline CEMP [TR030008/APP/6.5]**:

a. Design for reuse and recovery: identifying, securing and using materials that already exist on site, or can be sourced from other projects.

b. Design for materials optimisation: simplifying the Project layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content.

c. Design for off-site construction: maximising the use of pre-fabricated structures and components, encouraging a process of assembly rather than construction.

d. Design for the future (deconstruction and flexibility): identify how materials can be designed to be more easily adapted over an asset lifetime and how deconstructability and demountability of elements can be maximised at end of first life.

e. Design for materials and waste efficient procurement: identify and specify materials that can be acquired responsibly, in accordance with a recognised industry standard.

20.7.6 As per the IEMA Guidance, embedded measures are considered prior to the assessment of effects to avoid considering assessment scenarios that are unrealistic in practice i.e. do not take account of such measures even though they are likely to be standard practice and/ or form part of the Project design. Taking these measures into account is necessary to identify the realistic likely environmental effects. Where likely significant adverse effects are identified after considering these embedded measures, Project specific mitigation measures will be considered, developed and proposed, where necessary and possible.

Standard Mitigation

20.7.7 Construction of the Project would be subject to measures and procedures defined within a Construction Environmental Management Plan ("CEMP"), which would be produced prior to the commencement of construction by the Contractor and would be based on, and incorporate, the contents and requirements of the **Outline CEMP** submitted with the DCO Application (**[TR030008/APP/6.5]**). In addition, an OSWMP which forms part of the **Outline CEMP** has been prepared and accompanies the DCO application (**[TR030008/APP/6.5]**). The Contractor will prepare a SWMP before the commencement of construction, in accordance with the OSWMP. The OSWMP sets out the generic measures that will be implemented by the Contractor to manage waste generated by the Project construction. This OSWMP includes:

a. An overview of applicable legislation.

b. Details of the Project.

c. Management arrangements, including roles and responsibilities, training, targets and best practice measures.

d. Estimates of construction material use and waste arising and how they will be managed.

e. Design decisions.

f. Materials and waste management on-site.

g. Opportunities for waste minimisation, reuse, recycling and recovery in line with the requirements of the waste hierarchy.

20.7.8 Targets for waste recovery and recycled content will be included in the contractor's SWMP and could include for example:

a. Achieving a set percentage (by weight) for recovery of non-hazardous C&D waste. Such a target would specifically exclude naturally occurring materials with EWC Code 17 05 04 (soil and stones other than those mentioned in 17 05 03* (soils and stones containing dangerous substances)). Recovery is deemed to include reuse, recycling and other recovery e.g. energy recovery.

b. Achieving a set percentage (by weight) of materials imported to site for use within the Project containing alternative (reused, recycled or secondary) content, for those applications where it is technically and economically feasible to substitute these alternatives to primary materials.

20.7.9 The reuse of excavated material would be covered by a CL:AIRE DoW CoP (Ref 20-20) MMP developed by the Contractor before the commencement of construction and for obtaining all necessary approvals (in accordance with the CEMP) **[TR030008/APP/6.5]**. This would support the re-use of excavated materials; minimise off-site disposal; and demonstrate the necessary lines of evidence to support the proper reuse/ offsite disposal of materials and ensure compliance with regulatory guidance.

20.8 Assessment of Likely Impacts and Effects

Potential Impacts

20.8.1 Potential materials and waste impacts associated with the Project include:

a. Reduction in materials required for construction available in the relevant markets (key construction materials e.g. concrete, asphalt, steel, aggregates).

b. Effects that on-site generated materials (e.g. soils, waste arisings) have on the existing and future landfill void capacity during Project construction.

c. Effects that on-site generated waste arisings have on the existing and future landfill void capacity during Project operation.

d. Changes to allocated/ safeguarded waste site access.

Construction

20.8.2 **Table 20-21** summarises the likely types of materials that would be used and wastes that are likely to be generated during the Project construction phase.

Table 20-21: Construction Material Use and Waste Types Arising from Project Construction

Construction Activity	Materials Used	Waste Types Generated
Site remediation/ preparation/ earthworks	Fill material for construction purposes. Primary/secondary/recycled aggregates for ground stabilisation. Topsoil and subsoil for landscaping and restoration.	Surplus excavated materials. Surplus topsoil and subsoil. Unsuitable and contaminated soils and excavated materials. Vegetation from site clearance.
Site clearance and demolition activities	Materials are not required for demolition works.	Waste arisings from demolition and clearance. Extensive demolition is not anticipated as the site is either hardstanding, brownfield or agricultural field.

Construction Activity	Materials Used	Waste Types Generated
Site construction	Main construction materials including: • Concrete • Steel • Pipe supports • Cables, cable trays and instruments • Asphalt • Piles • Gravel • Fill material	Excess, offcuts and broken/ damaged construction materials. Existing infrastructure removed during works. Packaging from materials delivered to site e.g. timber crates. Construction worker wastes from offices and welfare areas/ canteens. Waste oils from construction plant.

Construction Materials

20.8.3 The estimated main types and quantities of materials anticipated to be used during construction of the various Project phases (Phase 1-6) have been obtained from the Applicant, as presented in **Table 20-22**, **Table 20-24, Table 20-26** and **Table 20-28** alongside national and regional materials consumption. Regional material consumption is not available for steel.

20.8.4 Phase 1 is anticipated to be three years, and each subsequent Phase (2-6) would be two years each. Phase 4 Phase 5 and Phase 6 are anticipated to overlap by one year. A worst case that all material is used within one year for each Phase is taken in the assessment.

20.8.5 **Table 20-22**, **Table 20-24, Table 20-26** and **Table 20-28** also include potential material wastage estimates and a total construction waste estimate based on material wastage only. Asphalt material quantities have been converted from m^2 to m^3 by assuming a depth of 170mm.

20.8.6 Data on the bulk density of materials has been used to convert quantities between volume (m^3) and weight (tonnes). Information on the typical bulk density of materials has been sourced from the Bath Inventory of Carbon and Energy ("ICE") (Ref 20-33) and align with the Climate Change assessment in **Chapter 19: Climate Change [TR030008/APP/6.2]**. Material measured in metres and number have been converted to tonnes based on conversion factors from the National Highways Carbon Emissions Calculation Tool (Ref 20-34).

20.8.7 A wastage rate of 5% has been applied to all construction materials. The rate is based on the highest "good practice" rates from WRAP's Designing Out Waste Tool for Civil Engineering (Ref 20-27) for the key construction materials.

20.8.8 There is no baseline information for plastic and there is no regional baseline for steel.

Table 20-22: Estimated Construction Material Quantities and Wastage – Phase 1

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Waste Quantity (tonnes)	Waste Quantity (m^3)
Concrete	2.4	128,018	53,341	5	6,401	2,667
Rebar - steel	8	4,862	608	5	243	30
Structural steel	8	3,909	489	5	195	24
Pipe erection – pre-cast concrete	2.4	123,154	51,314	5	6,158	2,566
Pipe supports - CS - steel	8	96	12	5	5	1
Pipe supports - SS - steel	8	4	1	5	0.2	0.03
Electrical cable supply - plastic	8	107	13	5	5	1
Electrical cable trays - plastic	1.4	54	39	5	3	2
Instrument cables - steel	8	131	16	5	7	1
Instrument cable trays - plastic	1.4	242	173	5	12	9
Equipment - steel	8	11	1	5	1	0.1
Asphalt	2.3	20,969	9,117	5	1,048	456
Piles - steel	8	10,530	1,316	5	527	66

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Waste Quantity (tonnes)	Waste Quantity (m^3)
Gravel - aggregate	2	13,272	6,636	5	664	332
Fill material - aggregate	2	351,156	175,578	5	17,558	8,779
Total material construction waste					**32,826**	**14,933**

Table 20-23: Estimated Construction Material Quantities and % of National and Regional Consumption – Phase 1

Total Construction Materials	Quantity (tonnes)	National Material Consumption (million tonnes)	% of National Material Consumption	Magnitude of Impact	Sensitivity	Effect	Regional Material Consumption (million tonnes)	% of Regional material Consumption	Magnitude of Impact	Sensitivity	Effect
Concrete	251,172	86.2	0.3	Negligible	Low	Slight	6.2	4	Minor	Low	Slight
Steel (rebar and structural steel)	19,651	17	0.1	Negligible	Low	Slight	n/a	n/a	n/a	Low	n/a
Asphalt	20,969	25.4	0.1	Negligible	Low	Slight	4.9	0.4	Negligible	Low	Slight
Aggregates (fill material and gravel)	364,428	250.9	0.1	Negligible	Low	Slight	46.4	0.8	Negligible	Low	Slight

Table 20-24: Estimated Construction Material Quantities and Wastage – Phase 2

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Quantity (tonnes)	Quantity (m^3)
Concrete	2.4	29,640	12,350	5	1,482	618
Rebar - steel	8	1,061	133	5	53	7
Structural steel	8	717	90	5	36	4
Pipe erection – pre-cast concrete	2.4	48,428	20,178	5	2,421	1,009
Pipe supports - CS - steel	8	39	5	5	2.0	0
Pipe supports - SS - steel	8	1	0	5	0.06	0.0
Electrical cable supply - plastic	8	29	4	5	1.5	0
Electrical cable trays - plastic	1.4	16	11	5	1	1
Instrument cables - steel	8	71	9	5	3.5	0
Instrument cable trays - plastic	1.4	140	100	5	7	5
Equipment - steel	8	4	1	5	0.22	0.0
Asphalt	2.3	1,112	483	5	56	24
Piles - steel	8	3,640	455	5	182	23

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Quantity (tonnes)	Quantity (m^3)
Gravel - aggregate	2	3,474	1,737	5	174	87
Fill material - aggregate	2	-	-	5	-	-
Total material construction waste based on wastage					**4,419**	**1,778**

Table 20-25: Estimated Construction Material Quantities and % of National and Regional Consumption – Phase 2

Total Materials by Category	Quantity (tonnes)	National Material Consumption (million tonnes)	% of National Material Consumption	Magnitude of Impact	Sensitivity	Effect	Regional Material Consumption (tonnes)	% of Regional Material Consumption	Magnitude of Impact	Sensitivity	Effect
Concrete	78,068	86.2	0.09	Negligible	Low	Slight	6.2	1.3	Minor	Low	Slight
Steel (rebar and structural steel)	5,563	17	0.033	Negligible	Low	Slight	n/a	n/a	n/a	n/a	n/a
Asphalt	1,112	25.4	0.004	Negligible	Low	Slight	4.9	0.02	Negligible	Low	Slight
Aggregates (fill material and gravel)	3,474	250.9	0.001	Negligible	Low	Slight	46.4	0.007	Negligible	Low	Slight

Table 20-26: Estimated Construction Material Quantities and Wastage – Each Subsequent Phase (3-6)

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Quantity (tonnes)	Quantity (m^3)
Concrete	2.4	25,066	10,444	5	1,253	522
Rebar - steel	8	888	111	5	44	6
Structural steel	8	396	50	5	20	2
Pipe Erection – pre-cast concrete	2.4	28,680	11,950	5	1,434	597
Pipe supports - CS - steel	8	24	3	5	1.2	0
Pipe supports - SS - steel	8	1	0	5	0.06	0.0
Electrical cable supply - plastic	8	17	2	5	0.9	0
Electrical cable trays - plastic	1.4	8	6	5	0.4	0.3
Instrument cables - steel	8	67	8	5	3.3	0
Instrument cable trays - plastic	1.4	135	96	5	7	5
Equipment - steel	8	4	0	5	0.18	0.0
Asphalt	2.3	2,097	912	5	105	46
Piles - steel	8	2,822	353	5	141	18

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Quantity (tonnes)	Quantity (m^3)
Gravel - aggregate	2	2,648	1,324	5	132	66
Fill material - aggregate	2	-	-	5	-	-
Total material construction waste based on wastage					3,143	1,263

Table 20-27: Estimated Construction Material Quantities and % of National and Regional Consumption – Each Subsequent Phase (3-6)

Total Materials by Category	Quantity (tonnes)	National Material Consumption (tonnes)	% of National Material Consumption	Magnitude of Impact	Sensitivity	Effect	Regional Material Consumption (tonnes)	% of Regional Material Consumption	Magnitude of Impact	Sensitivity	Effect
Concrete	53,745	86.2	0.06	Negligible	Low	Slight	6.2	0.9	Negligible	Low	Slight
Steel (rebar and structural steel)	4,218	17	0.02	Negligible	Low	Slight	n/a	n/a	n/a	n/a	n/a
Asphalt	2,097	25.4	0.008	Negligible	Low	Slight	4.9	0.04	Negligible	Low	Slight
Aggregates (fill material)	2,648	250.9	0.001	Negligible	Low	Slight	46.4	0.01	Negligible	Low	Slight
Note: For the total quantity of construction material for Phases 3-6, the above figures should be multiplied by four, as they only show the estimates for one Phase.											

Table 20-28: Estimated Construction Material Quantities and Wastage – Jetty

Material	Material Density (t/m^3)	Quantity (tonnes)	Quantity (m^3)	Wastage Rate (%)	Quantity (tonnes)	Quantity (m^3)
In situ concrete	2.4	15,927	6,636	5	797	332
Pre-cast concrete	2.4	7,031	2,929	5	352	146
Reinforcement - steel	8	1,912	239	5	96	12
Bracing and sleeves - steel	8	669	84	5	33	4
Piles - steel	8	18,411	2,301	5	921	115
Crosshead - steel	8	3,399	425	5	170	21
Road beams and structural PR - steel	8	3,804	475	5	190	24
Mooring dolphin jackets - steel	8	309	39	5	15	2
Fill - aggregates	2	5,350	2,675	5	268	134
Total material construction waste based on wastage					2,841	790

Table 20-29: Estimated Construction Material Quantities and % of National and Regional Consumption – Jetty

Total Materials by Category	Quantity (tonnes)	National Material Consumption (tonnes)	% of National Material Consumption	Magnitude of Impact	Sensitivity	Effect	Regional Material Consumption (tonnes)	% of Regional Material Consumption	Magnitude of Impact	Sensitivity	Effect
`Concrete	22,958	86,200,000	0.03	Negligible	Low	Slight	6,240,000	0.4	Negligible	Low	Slight
Steel (reinforcement, bracing and sleeves, piles, crosshead, road beams and structural PR, and mooring dolphin jackets)	28,504	17,000,000	0.2	Negligible	Low	Slight	n/a	n/a	n/a	n/a	n/a
Aggregates (fill)	5,350	250,900,000	0.002	Negligible	Low	Slight	46,400,000	0.012	Negligible	Low	Slight

Table 20-30: Estimated Construction Material Quantities and % of National and Regional Consumption – Phase 1, Phase 2, Each Subsequent Phase (3-6) and Jetty Total

Total Materials by Category	Quantity (tonnes)	National Material Consumption (tonnes)	% of National Material Consumption	Magnitude of Impact	Sensitivity	Effect	Regional Material Consumption (tonnes)	% of Regional Material Consumption	Magnitude of Impact	Sensitivity	Effect
Concrete	567,179	86,200,000	0.7	Negligible	Low	Slight	6,240,000	9.1	Moderate	Low	Slight
Steel	70,590	17,000,000	0.4	Negligible	Low	Slight	n/a	n/a	n/a	n/a	n/a
Asphalt	30,469	25,400,000	0.1	Negligible	Low	Slight	4,900,000	0.6	Negligible	Low	Slight
Aggregates	383,844	250,900,000	0.2	Negligible	Low	Slight	46,400,000	0.8	Negligible	Low	Slight

20.8.9 Materials required for Project construction are determined to be receptors of low sensitivity (in accordance with **Table 20-3**).

20.8.10 On a national scale during the Phase 1 construction phase no individual construction material requirement is equal to or greater than 1% by weight of the baseline national consumption (UK/GB) (i.e. concrete 0.3%, steel 0.1%, asphalt 0.1% and aggregates 0.1% as shown in **Table 20-23**).

20.8.11 The magnitude of impact is considered to be negligible (in accordance with **Table 20-6**). The overall effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.12 On a regional scale during Phase 1 construction, asphalt and aggregates requirements are less than 1% by weight of the baseline regional consumption (i.e. asphalt 0.4% and aggregates 0.8% as shown in **Table 20-23**). The magnitude of impact for asphalt and aggregates is considered to be negligible. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.13 Concrete requirements represent between 1-5% of the baseline regional consumption (i.e. concrete 4% as shown in **Table 20-23**). The magnitude of impact for concrete is considered to be minor. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.14 On a national scale during the Phase 2 construction phase no individual construction material requirement is equal to or greater than 1% by weight of the baseline national consumption (UK/GB) (i.e. concrete 0.09%, steel 0.03%, asphalt 0.004% and aggregates 0.001% as shown in **Table 20-25**).

20.8.15 The magnitude of impact is considered to be negligible (in accordance with **Table 20-6**). The overall effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.16 On a regional scale during Phase 2 construction, asphalt and aggregates requirements are less than 1% by weight of the baseline regional consumption (i.e. asphalt 0.02% and aggregates 0.007% as shown in **Table 20-25**). The magnitude of impact for asphalt and aggregates is considered to be negligible. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.17 Concrete requirements represent between 1-5% of the baseline regional consumption (i.e. concrete 1.3% as shown in **Table 20-25**). The magnitude of impact for concrete is considered to be minor. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.18 Since material quantity requirements for subsequent Project Phases (3-6) are lower than those required during Phase 1 and Phase 2 no individual construction material requirement is equal or greater than 1% at a national or regional scale (as outlined in **Table 20-27**) no significant effects are anticipated.

20.8.19 At a national scale during jetty construction, no individual construction material requirements are equal to or greater than 1% by weight of the baseline national consumption (UK/GB) (i.e. concrete 0.05% steel 0.1%, and aggregates 0.002%). The magnitude of impact is considered to be negligible. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.20 At a regional scale during jetty construction, no individual construction material requirements are equal to or greater than 1% by weight of the baseline regional consumption (i.e. concrete 0.7% and aggregates 0.012% as outlined in **Table 20-29**). The magnitude of impact is considered to be negligible. The effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.21 At a national scale in a worst-case scenario that Phase 1, Phase 2, Phases 3-6 and the jetty are constructed within a single year material requirement is less than 1% by weight of the baseline national consumption (UK/GB) (i.e. concrete 0.7%, steel 0.4%, asphalt 0.1% and aggregates 0.2% as outlined in **Table 20-30**). The magnitude of impact is considered to be negligible for concrete, asphalt, aggregates and steel. The overall effect is therefore assessed to be **slight adverse** which is **not significant**.

20.8.22 At a regional scale in a worst-case scenario that Phase 1, Phase 2, Phases 3-6 and the jetty are constructed within a single year, asphalt and aggregates requirements are less than 1% by weight of the baseline regional consumption (i.e. asphalt 0.6% and aggregates 0.8% as outlined in **Table 20-30**). Concrete requirements represent more than 5% of the baseline regional consumption (i.e. concrete 9.5% as outlined in **Table 20-30**).

20.8.23 For asphalt and aggregates the magnitude of impact is considered to be negligible. The overall effect is therefore assessed as **slight adverse** which is **not significant**.

20.8.24 For concrete the magnitude of impact is considered to be moderate. The overall effect is therefore assessed as **slight adverse** which is **not significant**.

Construction Waste

20.8.25 The construction waste estimates based upon wastage from construction material is likely to be an underestimation of total construction waste as this does not include worker waste, waste from vehicles etc. Therefore, construction waste volumes have also been estimated at a high-level based on the Project construction value.

20.8.26 The construction waste estimates (excluding demolition and excavation) have been calculated based on the construction value and published best practice benchmarks for industrial buildings (Ref 20-36). A best practice benchmark has been used since waste generation is expected to be at the lower end of the scale since much of the capital expenditure will be associated with modular process engineering components which will be manufactured off-site, and hence the on-site waste generation from assembly of these components is expected to be relatively small.

20.8.27 **Table 20-31** outlines the estimated construction waste based on construction value.

Table 20-31: Construction Waste Based on Construction Value

Phase	Construction Waste Based on Construction Value (m^3)
Phase 1	22,000
Phases 2-6	41,250
Phase 1 - jetty	10,450
Total	73,700

20.8.28 In a worst case that Phase 1, Phases 2-6 and the jetty are constructed within a single year construction waste volume is estimated to be 73,700m^3 and this is the construction waste estimate used in the assessment.

20.8.29 At this stage no estimates of hazardous waste generation during Project construction are available. Detailed waste quantities would be estimated by the contractor and included in the SWMP. The quantities of hazardous waste (e.g. oils, batteries, aerosol cans etc.) are anticipated to be small compared to the overall construction waste arisings.

Demolition and Clearance Waste

20.8.30 Large scale demolition works during the construction phase are not anticipated given that the Project site comprises hardstanding, brownfield and agricultural fields. Therefore, quantities of waste generated during site clearance activities and the demolition of existing buildings are anticipated to be small.

20.8.31 The quantity of waste estimated to arise from vegetation clearance for is based on the number of hectares (ha) expected to be cleared, the vegetation type (heavily wooded or medium wood) and a benchmark for m^3 and tonnes of waste per ha. The benchmarks are:

a. Heavily wooded - 429m^3 per ha, 300 tonnes per ha.

b. Medium wooded – 250m^3 per ha, 175 tonnes per ha.

20.8.32 Taking into account the above, during vegetation clearance works for Phase 1 it is estimated that 3,683m^3 of material would be generated. It is anticipated that all of this waste would be composted or recovered on or off site with a 100% recovery rate and therefore would not impact landfill void capacity.

Excavated Material

20.8.33 The Project design is currently being progressed to optimise the requirements for cut and fill and where possible this will be minimised to reduce the import and export of materials and waste. The Project design team aim is to achieve a cut-fill balance, however predicted cut and fill for the Phase 1 is currently imbalanced with import required i.e. cut volume of approximately 22,336m^3 and a fill volume of approximately 175,578m^3.

20.8.34 For the jetty predicted cut is 2,019m^3 which is associated with a 300m deep strip as part of the vegetation clearance. Fill requirements are 1,610m^3 for the

temporary crane platform and vehicle turning area and 1,065m^3 for the temporary vehicle access route. Since these elements are temporary it is assumed that this material would become a waste at the end of construction (a total of 2,675m^3). The fill requirements are also considered in the construction material assessment in **Table 20-29**.

20.8.35 The use of site-sourced excavated material within the Project engineering works activities would be undertaken in accordance with the MMP. This would be prepared by the Contractor in accordance with the CL:AIRE DoW CoP (Ref 20-20) with the material not being classified as waste.

20.8.36 For Phase 1 a worst-case scenario where all approximately 22,336m^3 of excavated material is sent to landfill has been applied.

20.8.37 In practice, it is likely that some of the excavated material could be reused on-site or recovered, rather than being disposed of to landfill. Information on previously developed land and potential sources of contamination that could give rise to materials and waste that require specific handling, storage and management arrangements, are set out in **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]**.

Total Construction Phase Waste

20.8.38 **Table 20-32** presents a summary of construction phase waste. A worst case that all waste generation occurs within one year is taken in the assessment.

Table 20-32: Total Construction Phase Waste

Activity	Waste (m^3)
Construction waste Phase 1, Phase 2, subsequent Phases (3-6) and jetty (based on construction value)	73,700
Demolition and clearance waste Phase 1 and Jetty	Small quantities as outlined in **Paragraph 20.8.30.** Vegetation clearance unlikely to have an impact on landfill capacity
Excavated material Phase 1	22,336
Excavated material Jetty	2,019
Waste aggregates - at the end of construction from jetty temporary crane platform and vehicle turning area and temporary vehicle access route	2,675
Total	100,730
% of Inert and Non-Hazardous Landfill Capacity	0.08%

20.8.39 Based on the above, construction of the Project is estimated to result in less than a 1% (1,040,110m^3) reduction of landfill capacity within the waste management study area, representing a negligible magnitude of impact.

20.8.40 Waste receptors of relevance to the Project are determined to have a very high sensitivity. Therefore, a negligible magnitude of impact would result in a **slight adverse** effect which is **not significant**.

20.8.41 At this stage no estimates of hazardous waste generation during Project construction are available (see **Paragraph 20.8.29**). The quantities of hazardous waste (e.g. oils, batteries, aerosol cans etc.) are currently anticipated to be small compared to the overall construction waste arisings and anticipated to be less than 0.1% of the hazardous waste landfill capacity in England (12,107m^3) – as such the magnitude of impact is anticipated to be negligible.

20.8.42 Many hazardous waste types have well defined waste management routes, including recovery and are unlikely to be sent directly to landfill. Procedures for the storage and management of these wastes are set out in the OSWMP and would be further detailed in the Contractor's SWMP. Hazardous waste receptors have a very high sensitivity. Therefore, a negligible magnitude of impact would result in a **slight adverse** effect which is **not significant**.

Impacts on Safeguarded Waste Sites

20.8.43 Consultation in relation to the safeguarding of allocated / safeguarded waste sites in the vicinity of the Project (described in **Table 20-14**) has not been undertaken since the following has been confirmed:

a. Access to and operation of the Grimsby Operations Ltd, Household Waste Recycling Centre, Queens Road, Immingham is unaffected by the adjacent IGET development.

b. The access road to the permitted landfill operated by Integrated Waste Management Ltd, Queens Road, Immingham is outside of the west site perimeter fence and operational access will be maintained at all times.

20.8.44 Permanent impacts upon allocated/ safeguarded waste sites are not anticipated: any Project impacts on site access would be of limited duration (during construction only), whilst alternative access arrangements would be put in place during this time in order to avoid undue disruption.

20.8.45 No significant effects on safeguarded waste sites are anticipated.

Operation

20.8.46 Effects associated with the availability of materials during Project operation have been scoped out of the assessment.

20.8.47 Operational wastes from the Project include:

a. Waste from the control room, workshop e.g. general wastes.

b. Waste from the operation of hydrogen production units and liquefiers.

20.8.48 The main waste types and quantities of operational waste are outlined in **Table 20-33.**

20.8.49 Some wastes will be generated infrequently e.g. every 5-6 years, whereas some wastes will be generated annually or continuously. For the purpose of the

assessment a worst case that all operational wastes are generated within the same year has been used.

Table 20-33: Operational Waste Arisings

Waste Type	Waste Description	Frequency of Disposal	Waste Classification	Estimated Quantity (tonnes)	Estimated Quantity (m^3)
Catalyst (hazardous)	Solid	2-3 years	Hazardous	Not applicable (n/a), assessed in m^3 only	2
Catalyst (non-hazardous)	Solid	5-6 years	Non-hazardous		15
Diesel	Liquid	Annual total	Hazardous	1	n/a, assessed in tonnes only
Ammonia solution	Liquid	1-2 years	Hazardous	228	n/a, assessed in tonnes only
Compressor oil	Liquid	Annual total	Hazardous	1	n/a, assessed in tonnes only
General waste	Solid	Annual total	Non-hazardous	n/a, assessed in m^3 only	95
Packaging	Solid	Annual total	Non-hazardous		48
Scrap metals	Solid	Annual total	Non-hazardous		24
Total liquid hazardous waste (tonnes)				230	
Total solid hazardous waste (m^3)					7
Total solid non-hazardous (m^3)					182

20.8.50 The IEMA Guidance (Ref 20-1) recommends assessing impacts of hazardous waste with reference to the available landfill capacity nationally. However, since some of the operational hazardous wastes likely to be generated by the Project will not be suitable for landfill disposal (e.g. liquid waste), hazardous operational waste is compared to national hazardous waste management facility capacity in this assessment.

20.8.51 In the event that non-hazardous solid wastes are disposed of to landfill, the annual quantity is likely to be a reduction of <1% (0.0003%) of regional non-hazardous waste landfill void capacity and is considered to be of negligible magnitude. Accordingly, as for inert and non-hazardous waste the sensitivity of the receptor is classified as 'very high' and the magnitude of impact is considered to be 'negligible', this is assessed to result in a **slight adverse** effect which is **not significant**.

20.8.52 In a worst case scenario where hazardous solid wastes are disposed of to landfill, the annual quantity is likely to be a reduction of <0.1% (0.0001%) of national hazardous waste landfill void capacity and is considered to be of negligible magnitude. Accordingly, as for hazardous waste the sensitivity of the receptor is classified as 'very high' and the magnitude of impact is considered to be 'negligible', this is assessed to result in a **slight adverse** effect which is **not significant**.

20.8.53 If hazardous liquids not suitable for landfill disposal (i,e. diesel, ammonia solution and compressor oil) are disposed of by high temperature incineration the waste from the Project would be equivalent to 0.18% of 2021 hazardous waste incineration waste input (at a national level).

20.8.54 If hazardous liquids are managed by hazardous liquid waste treatment facilities the waste from the Project would be equivalent to 0.04% of 2021 hazardous liquid waste treatment input (at a national level).

Decommissioning

20.8.55 The landside elements (Phases 1-6) of the Project have a design life of up to approximately 25 years although the operational life could be longer, and when appropriate, this infrastructure would be decommissioned and all materials removed would be reused or recycled where possible or disposed of in accordance with relevant waste disposal regulations at the time of decommissioning. The DCO application does not make any provision for the decommissioning of the marine infrastructure and this is discussed further in **Chapter 2: The Project [TR030008/APP/6.2]**. However, plant and equipment on the jetty topside would be decommissioned.

20.8.56 It is not possible to assess waste and material resources effects of decommissioning of landside elements and the jetty topside infrastructure at the present time, since waste infrastructure, technologies and good practices are likely to be substantially different to those currently in place: specific measures would be addressed as part of a DEMP produced prior to the decommissioning phase. The facility design is to, as far as possible use a flexible modular construction and this approach makes decommissioning easier, quicker and means it has lower environmental impact by preventing waste generation. The process plant is constructed mainly from metals that are easy to reuse or recycle, individual items of equipment may be removed and redeployed. There is no underground storage that would require removal.

20.8.57 An **Outline DEMP** (**[TR030008/APP/6.6]**) accompanies this DCO Application and a detailed DEMP will be secured via a Requirement of the DCO.

20.8.58 In a worst-case scenario, where the Project elements would be fully removed, the potential impacts during the decommissioning phase would be similar to those encountered during the Project construction phase. An estimate of decommissioning waste is provided in **Table 20-34**.

Table 20-34: Decommissioning Waste Estimate

Waste Type	Quantity (m^3)	Quantity (tonnes)
Concrete	119,292	286,300
Steel	5,235	41,879
Asphalt	13,247	30,469
Plastic	759	1,232
Total Waste Decommissioning	137,774	359,880

20.9 Mitigation and Enhancement Measures

20.9.1 The assessment presented in **Section 20.8** has indicated that no significant effects with regards to materials and waste are anticipated to arise as a result of the Project. Therefore, no additional mitigation or enhancement measures other than those set out in **Section 20.7** are considered necessary.

20.10 Assessment of Residual Effects

20.10.1 Based upon the assessment as detailed in **Section 20.8**, no significant residual effects with regard to materials and waste are anticipated.

20.11 Summary of Assessment

20.11.1 Based on the current understanding of material and waste quantities associated with the Project, no significant effects are anticipated.

20.11.2 A summary of potential materials and waste impacts, mitigation measures and residual effects is presented in **Table 20-35**.

Table 20-35: Summary of Potential Impact, Mitigation Measures and Residual Effects

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Construction Phase					
Waste - Non-hazardous landfill void capacity in the expansive study area of East Midlands and Yorkshire and the Humber.	Changes in available landfill capacity.	The sensitivity of the receptor is classified as very high, with a negligible magnitude of impact resulting in a slight adverse effect which is not significant.	Mitigation outlined in **Section 20.7**.	Slight adverse effect which is not significant.	Confidence level of significance of effects prediction is moderate-high. Assessment based on industry standard guidance and precautionary assumptions. Waste estimate is reasonable worst case based on industry benchmarks.
Waste - Hazardous landfill void capacity in the expansive study area England.	Changes in available landfill capacity.	The sensitivity of the receptor is classified as very high, with a negligible magnitude of impact resulting in a slight adverse effect which is not significant.	Mitigation outlined in **Section 20.7**.	Slight adverse effect which is not significant.	Confidence level of significance of effects prediction is moderate-high. Assessment based on industry standard guidance and precautionary assumptions. Waste estimate is reasonable worst case based on industry benchmarks and construction value.

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Materials - national and regional consumption of key construction materials.	Changes in demand for materials.	When each phase is considered individually the sensitivity of the receptor is classified as low, with a negligible or minor (dependent on material type) magnitude of impact resulting in a slight adverse effect which is not significant. In a worst-case scenario that Phase 1, Phase 2-6 and the jetty are constructed within a single year the sensitivity of the receptor is classified as low, with a negligible, or moderate (dependent on material type) magnitude of impact resulting in a slight adverse effect which is not significant.	Mitigation outlined in **Section 20.7**.	Slight adverse effect which is considered to be not significant.	Confidence level of significance of effects prediction is moderate-high. Assessment based on industry standard guidance and precautionary assumptions. Material estimate has been provided by the Applicant and Air Products based on professional judgement.
Waste – Safeguarded waste sites.	Impacts on safeguarded waste sites and associated access.	Not significant.	None	Not significant.	Confidence level of significance of effects prediction is high. Based on information from the Applicant and Air Products on the location of works.

Receptor	Impact Pathway	Effect Significance	Mitigation Measures	Residual Effect	Confidence
Operational Phase					
Waste - Non-hazardous landfill void capacity in the expansive study area of East Midlands and Yorkshire and the Humber.	Changes in available landfill capacity.	The sensitivity of the receptor is classified as very high, with a negligible magnitude of impact resulting in a slight adverse effect which is not significant.	Mitigation outlined in **Section 20.7**.	Slight adverse effect which is not significant.	Confidence level of significance of effects prediction is moderate-high. Assessment based on industry standard guidance and precautionary assumptions. Waste estimate is reasonable worst case based on information from the Applicant and Air Products.
Waste - Hazardous landfill void capacity in the expansive study area England.	Changes in available landfill capacity.	The sensitivity of the receptor is classified as very high, with a negligible magnitude of impact resulting in a slight adverse effect which is not significant.	Mitigation outlined in **Section 20.7**.	Slight adverse effect which is not significant.	Confidence level of significance of effects prediction is moderate-high. Assessment based on industry standard guidance and precautionary assumptions. Waste estimate is reasonable worst case based on information from the Applicant and Air Products.

20.12 References

Ref 20-1 IEMA, (2020), Guide to: Materials and Waste in Environment Impact Assessment, Guidance for a Proportionate Approach.

Ref 20-2 European Union, (2008), Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste and Repealing Certain Directives.

Ref 20-3 His Majesty's Stationary Office (HMSO), (2011), Waste (England and Wales) Regulations 2011 as amended.

Ref 20-4 HMSO, (2019), The Waste (Miscellaneous Amendments) (EU Exit) Regulations 2019.

Ref 20-5 HMSO, (1990), Environmental Protection Act 1990 as amended.

Ref 20-6 HMSO, (2016), The Environmental Permitting (England and Wales) Regulations 2016.

Ref 20-7 HMSO, (2005), Hazardous Waste (England and Wales) Regulations 2005 as amended.

Ref 20-8 European Union, (1991), Directive 91/689/EEC of the European Parliament and of the Council of 12 December 1991 on Hazardous Waste.

Ref 20-9 HMSO, (2021), The Environment Act.

Ref 20-10 Department for Transport, (2012). National Policy Statement for Ports.

Ref 20-11 Ministry of Housing, Communities & Local Government, (2021), National Planning Policy Framework (NPPF).

Ref 20-12 Ministry of Housing, Communities & Local Government, (2014), National Planning Policy for Waste.

Ref 20-13 Department for Environment, Food & Rural Affairs, (2021), The Waste Management Plan for England.

Ref 20-14 Ministry of Housing, Communities & Local Government, (2014), Planning Policy Guidance for Minerals.

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Ref 20-16 Department for Environment, Food & Rural Affairs, (2018), A Green Future: Our 25 Year Plan to Improve the Environment.

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Ref 20-18 North East Lincolnshire Council, (2018), North East Lincolnshire Local Plan 2013 to 2032.

Ref 20-19 Ref 20.1 North East Lincolnshire Council, (2018), Policy Map, Minerals Safeguarding Area and Waste Sites.

Ref 20-20 Contaminated Land: Applications in Real Environments (CL:AIRE), (2011), Definition of Waste: Development Industry Code of Practice (DoWCoP), Version 2.

Ref 20-21 WRAP, (undated), Designing Out Waste: A Design Team Guide for Civil Engineering.

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Ref 20-28 Environment Agency, (2022), Environmental Permitting Regulations - Waste Sites.

Ref 20-29 Environment Agency, (2022), 2021 Waste Data Interrogator, Waste Received (Excel), Version 1.

Ref 20-30 Environment Agency, (2021), Historic Landfill Sites.

Ref 20-31 Department for Environment, Food & Rural Affairs (Defra), (2021). UK Statistics on Waste.

Ref 20-32 WRAP, (2007), Waste Recovery Quick Wins. Improving Recovery Rates without Increasing Costs.

Ref 20-33 University of Bath, (2011), Bath Inventory of Carbon and Energy (ICE).

Ref 20-34 National Highways, (2022) Carbon Emissions Calculation Tool.

Ref 20-35 Department for Environment, Food & Rural Affairs, (2011), Guidance on Applying the Waste Hierarchy.

Ref 20-36 WRAP, (undated), SMARTWaste Data and Reporting (projects completed at the end of November 2012).

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 21: Ground Conditions and Land Quality

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 21: Ground Conditions and Land Quality

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

21 Ground Conditions and Land Quality

21.1 Introduction

21.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project in relation to the topic of Ground Conditions and Land Quality and relates to the terrestrial/land side of the Project as shown in **Figure 21.1 [TR030008/APP/6.3]**.

21.1.2 The assessment has examined the potential for the construction, operation and decommissioning phases of the Project to result in likely significant effects in relation to the following landside receptors associated with the topic:

a. Human receptors – concerning the health of onsite and offsite workers and visitors in relation to their potential contact and/or exposure to contaminants.

b. Geological receptors – comprising superficial geology and bedrock geology, and geological sites designated for their conservation interest.

c. Soil receptors – comprising agriculturally graded soil resources.

d. Hydrogeological and hydrological receptors – comprising superficial and bedrock aquifers (both principal and secondary), surface water features and existing abstraction sites.

21.1.3 The assessment has been undertaken using information regarding Project construction, operation and decommissioning presented in **Chapter 2: The Project [TR030008/APP/6.2]**. Reference is made to the Works No.s defined and described in that chapter, these being the locations where the Project's landside elements and/or activities would be implemented. The location of the Works Nos. are illustrated on the **Works Plans [TR030008/APP/4.2]**.

21.1.4 The assessment has been prepared using topic-specific guidance (where available), taking account of the general methodology and approach to assessment described in **Chapter 5: EIA Process [TR030008/APP/6.2]**.

21.1.5 Given the interrelationships between the landside receptors identified in this chapter and those considered in other technical assessments reported in the Environmental Statement ("ES"), reference is made to the following complementary assessments which report effects on related landside and marine-based receptors, sites and interests:

a. **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]** – which presents information regarding sites protected for their nature conservation interest.

b. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** – which presents information regarding potential contamination and Nitrate Vulnerable Zones ("NVZ") associated with the marine environment.

c. **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** – which presents information regarding existing water bodies, existing and proposed drainage regimes, and dewatering.

d. **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** – which presents information relating to hazardous substances that can potentially affect human health.

e. **Chapter 23: Socio-economics [TR030008/APP/6.2]** – which presents information regarding existing farming regimes and agricultural operations.

f. **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** – which details the approach to, and findings of, the assessments undertaken to identify both the cumulative and in-combination effects of the Project.

21.1.6 This chapter is supported by the following Figures **[TR030008/APP/6.3]**:

a. **Figure 1.1: Site Location Plan**.

b. **Figure 2.3: Works Areas**.

c. **Figure 21.1: Superficial Geology and Artificial Geology (including study area)**.

d. **Figure 21.2: Bedrock Geology (including study area)**.

e. **Figure 21.3: Groundwater Features (including study area)**.

f. **Figure 21.4: West Site Constraints Plan**.

g. **Figure 21.5: East Site Constraints Plan**.

h. **Figure 21.6: Source Protection Zones (including study area)**.

i. **Figure 21.7: Agricultural Land Classification**.

j. **Figure 21.8: Previous Ground Investigations**.

21.1.7 The assessment also refers to technical information, data, studies and measures reported in the following appendices:

a. **Appendix 21.A: Agricultural Land Classification Survey Report [TR030008/APP/6.4]**.

b. **Appendix 21.B: Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**.Reference is also made to measures contained in an Outline Remediation Strategy for the landside elements of the Site, forming **Appendix 21.C [TR030008/APP/6.4]**. The Outline Remediation Strategy was informed by the Ground Investigation undertaken within Work No. 3 East Site – Ammonia Storage, Work No. 4 Laporte Road Culvert, Work No. 5 East Site – Hydrogen Production and Work No. 7 West Site. Therefore, the Outline Remediation Strategy relates to known contamination in Work No's 3, 3A, 5 and 5A and potential unknown contamination across the whole Site. The outline document will inform the development of a Final Remediation Strategy.

21.2 Consultation and Engagement

21.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the ground conditions and land quality assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on ground conditions and land quality.

21.2.2 A Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) was adopted by the Planning Inspectorate (on behalf of the Secretary of State) on 10 October 2022. This identified a number of overarching and topic-specific matters that were subsequently brought into the overall scope of the assessment.

21.2.3 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act") (Ref 21-1). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

21.2.4 Between completion of the scoping exercise and publication of the PEI Report, the Applicant's Ground Investigation (see **Appendix 21.B: Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4]**) identified a potential impact pathway and risk to the Project relating to aggressive ground conditions and the accumulation of ground gases at the Site, which it determined could have the potential to degrade the foundations of operational Project infrastructure (buildings and services). The consideration of potential impacts on this infrastructure was subsequently brought into the scope of the preliminary assessments and reported in the PEI Report, with 'Development Infrastructure' being included as a defined receptor. Subsequent to the publication of the PEI Report, the design-development process identified that the incorporation and use of appropriate construction materials (for example concrete) and inclusion of ground gas protection measures within the Project design would remove the risk of this potential pathway to result in damage. Further information regarding the design of operational Project infrastructure to avoid/mitigate this potential risk is provided in **Section 21.7**. Accordingly, impacts and effects on 'Development Infrastructure' receptors have been scoped out of the assessment and are not considered further.

21.2.5 Through consideration of the responses to the Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified.

21.2.6 A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act (Ref 21-1), and a PEI Report Addendum was publicised to support the consultation.

21.2.7 Consultation undertaken to inform this chapter, including a summary of comments raised in the formal scoping opinion (**Appendix 1.B [TR030008/APP/6.4]**) and those gathered in response to the formal consultation exercises and other pre-application engagement are summarised in **Table 21-1**, alongside a summary of how the Applicant's assessment has responded to this feedback.

Table 21-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report proposes to scope out impacts on soil during the operational phase as any effects would have already occurred during construction. The Inspectorate agrees that new effects on soils would be likely to occur during normal operations and therefore this matter can be scoped out of the ES.	This is noted by the Applicant, and based on its agreement to scoping out operational impacts on soil, the Applicant assumes that the Planning Inspectorate's response was intended to state "…that new effects on soils would be [un]likely to occur…". Accordingly, impacts and effects on soil during the operational phase of the Project have been scoped out of the assessment.
		The Scoping Report states that an Agricultural Land Classification survey may be required to determine the subdivision of land classified as Grade 3 into either Grade 3a or 3b. The ES should confirm the agricultural land grade based on a recognised approach (such as Natural England's TIN049) and demonstrate how the Proposed Development has sought to avoid use of areas of best and most versatile land. The impact of the Proposed Development on existing farming activities in the area should also be explained in the ES.	An agricultural land classification ("ALC") survey has been undertaken within the West Site and Laporte Road Temporary Construction Area in accordance with the Inspectorate's recommended guidance, the findings of which are reported in **Appendix 21.A: Agricultural Land Classification Survey Report [TR030008/APP/6.4]**. The results indicate the soils in the surveyed locations are ALC Grade 3b, and therefore not considered best and most versatile ("BMV"). Notwithstanding this classification, the Applicant has identified best practice measures to mitigate effects on agricultural soils, noting that the West Site supports an existing planning consent and local removal of soils has already taken place to create an access road; these are presented in **Section 21.9**. The impact of the Project on existing farming activities and agricultural operations has been

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			considered within **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.
		Paragraph 20.6.9 on 'relevant legislation, policy and technical guidance' focuses on legislation and policy. The ES should list the guidance applied. Where relevant, the ES should take into account the following guidance: • Ministry of Agriculture, Fisheries and Food (1988) The Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land. • Natural England (2012) Technical Information Note TIN049, Agricultural Land Classification: protecting the best and most versatile agricultural land • Stapleton, C., Reed, E., Gemmell, L., Adams, K. (eds) (2021) IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment.	The Applicant can confirm that the guidance noted by the Planning Inspectorate has been reviewed, and where relevant, this has been taken into account as part of the assessment of the Project's effects on agricultural land and soils.
	Environment Agency	We have reviewed this chapter and can advise that we are satisfied with the scope and methodology proposed to assess ground conditions and land quality.	The Environment Agency's response is noted by the Applicant.
	The Coal Authority	The Coal Authority has confirmed that the site is located within a coalfield. However, the site is not located within a Development High Risk Area. There are no recorded coal mining legacy hazards at depth. Therefore, the Coal Authority considers that no further consideration to a coal mining legacy as part of the ES and there is no requirement to contact the Coal Authority regarding the planning application.	**Section 21.6** provides information on coal mining activity relating to the Site Boundary.
		It is recommended to include the following text if planning permission is granted as part of the formal application: "*The proposed development lies within a coal mining area which may contain unrecorded coal mining related hazards. If any coal mining feature is*	**Section 21.6** presents information on the geology of the site. The chalk is at a significant thickness overlying potential coal measures,

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		encountered during development, this should be reported immediately to the Coal Authority on 0345 762 6848".	such that works at the Site are unlikely to impact coal mining features. The Coal Authority's recommended text is noted and has been included as a measure within the **Outline CEMP [TR030008/APP/6.5]**.
	Natural England	Natural England recommend that the impact of the proposed development on soils and the best and most versatile agricultural land should be considered with reference to paragraphs 5.13.8 and 5.13.15 National Policy Statement for Ports. It is also recommended that the ES describes the potential disturbance and damage to soils as part of the proposed development. The potential disturbance or loss of agricultural land, including the best and most versatile land, should be considered in the ES. The avoidance and minimisation of potential impact to soils and the best and most versatile agricultural land should be discussed in the ES, including site design, green infrastructure, biodiversity net gain, soil handling and sustainable re-use. Natural England note that an ALC may be required.	Due regard has been given to the National Policy Statement for Ports in the assessment with regard to soils, as summarised in **Section 21.8**. An ALC survey has been undertaken within the West Site and Laporte Road Temporary Construction Area, the findings of which are presented in **Appendix 21.A [TR030008/APP/6.4]**. Information on the ALC grading for the Site and soil chemistry is summarised in **Section 21.6**. The potential impacts and effects on soils are discussed in **Section 21.8** and are presented in **Table 21-19**. Measures to mitigate these impacts and effects are presented in **Section 21.9**.
		Natural England also note that the ES should discuss the potential for an increased pollution risk during the construction and operational phases of the proposed development.	The assessment of the construction and operational phases of the Project have considered the potential for increased pollution risk, as described in **Section 21.8**.
	North East Lincolnshire Council ("NELC")	In terms land quality (Section 20) NELC agree with the scope and methodology presented.	The Applicant notes the response from NELC.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	UK Health Security Agency	The UK Health Security Agency note that the potential land quality impacts during the operational phase, including soil impacts, that were scoped out may require further consideration in relation to Chapter 21 Major Accidents and Disasters. It is noted that an incident could be detrimental to land quality as well as the hydrology and neighbouring watercourses.	The assessment has considered the potential for neighbouring areas of land and hydrological receptors to be affected through the adoption of 500m and 1km study areas around the Site Boundary for specific interests, as defined in **Section 21.5.** The findings of the assessment are presented in **Section 21.8**; this includes effects relating to uncontrolled run-off and accidental releases of potential contaminants to hydrological features surrounding the Site Boundary during the operational phase of the Project. Operational mitigation measures in relation to incidents of potential detriment to land quality, hydrology and watercourses (including appropriate emergency environmental management plans and procedures) are presented in **Section 21.9**.
	The Coal Authority	I can confirm that having checked the Proposed Site Boundary of the project site, whilst the site lies within the coalfield, our records indicate that coal mining activity occurred at such depth that it is much less likely to pose a risk to the stability of ground and new development. Our records indicate no known or likely coal-mining legacy features at surface or shallow depth. The developer needs to remain mindful that their site falls within the coalfield, and if unrecorded coal-mining hazards are found, they should contact the Coal Authority for further advice.	**Section 21.6** provides information on coal mining activity relating to the Site Boundary. The Coal Authority will be contacted in the event unrecorded coal mining hazards are encountered at the Site during construction of the Project.
	Environment Agency	We have reviewed Chapter 21 of the PEI Report in relation to the protection of controlled waters only. We are satisfied that an appropriate approach for the management of potential risks posed by contamination at the site is being adopted. It is understood that a ground investigation is to be undertaken to support the land	A risk assessment has been undertaken as part of the ground investigation reported in **Appendix 21.B [TR030008/APP/6.4]** in accordance with the Environment Agency's Land Contamination Risk Management

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		contamination risk assessment, and a remediation strategy will be prepared to support the DCO application. We recommend that you: • Refer to our Guiding principles for land contamination for the type of information that we require in order to assess risks to controlled waters from the site – the local authority can advise on risks to other receptors, such as human health; • Consider using the National Quality Mark Scheme for Land Contamination Management which involves the use of competent persons to ensure that land contamination risks are appropriately managed; • Refer to the contaminated land pages on gov.uk for more information.	("LCRM") (Ref 21-22), and with reference to the its guiding principles for land contamination and guidance within contaminated land pages on the gov.uk website (as suggested by the Environment Agency).
		Paragraph 21.4.12 mentions that dewatering may be required to take place during construction. Should this be the case, the EA must be contacted in order to discuss abstraction licensing and environmental discharge permit requirements for such activities. Please note, the granting of an abstraction license and discharge permit is not guaranteed.	The **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.5]** includes measures placing an obligation on the contractor to engage the Environment Agency in the event that a requirement for dewatering during construction is identified.
	Polynt Composites	The project proposals for which development consent is being sought will necessitate the temporary acquisition of the Order Land. This is Polynt-owned land within the red line boundary for the DCO, which is currently in agricultural use and is actively farmed by a tenant farmer. According to the supporting documentation made available to date, the Order Land will be used as a construction compound during the construction phase of the IGET Project. Whilst the Order Land is most immediately affected by the IGET Project, assessing the impact of the same on the operation of the Plant and its employees is also of critical importance to Polynt. In the absence of appropriate mitigation, protective and safeguarding measures, the IGET Project could have a significant impact on the	A detailed ALC survey has been undertaken by the Applicant, the findings of which are reported in full in **Appendix 21.A [TR030008/APP/6.4]** and are summarised as part of the baseline conditions presented in **Section 21.6**. Matters relating to the potential future viability of farming operations on land required during construction of the Project, and potential effects on operation of the existing Polynt plant, have been considered within **Chapter 23: Socio-Economics**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		operations of the Plant and on the medium to longer term development potential of the Order Land. Given the proposed land take required to deliver the IGET Project and the impact this will have on the amenity of the area, traffic and transport and other associated impacts during the construction and operational phases, an optimum solution as regards the internal, physical reconfiguration of the Order Land will need to be identified, programmed and executed. Furthermore, any commercial and operational disruption to the Plant will need to be minimised and proactively managed not only during reconfiguration works but also during construction and operational phases of the IGET Project.	
		In relation to the Order Land, we require further clarity on the extent of the ground investigation work that is proposed at this location. We will require maximum comfort that the land will be remediated so that there is no impact on the land as a result of its temporary use as a construction compound. If the scheme proceeds, the Order Land must be restored to its current state (i.e. suitable for agricultural use) as a minimum. Thorough investigation work is necessary to ensure that any pre-existing conditions are identified and catalogued and a baseline set that can be referred back to and remediated where necessary post construction. This is particularly important as there is a risk of uncontrolled run off and accidental release of potential contaminants during both the construction and operational phase.	A ground investigation has been undertaken to establish existing ground conditions at the Site, the findings of which are reported in **Appendix 21.B [TR030008/APP/6.4]** Information relating to remediation is presented in the Outline Remediation Strategy contained within **Appendix 21.C [TR030008/APP/6.4]**. A Validation Report will be produced following any remediation works undertaken within the Site, this is contained within the **Outline CEMP [TR030008/APP/6.5]**.
	Alex Forster Wales and West Utilities	Our records show those pipes owned by Wales & West Utilities (WWU) in its role as a Licensed Gas Transporter (GT). Service pipes, valves, syphons, stub connections, etc. may not be shown but their presence should be anticipated. No warranties are therefore given in respect of it.	No WWU infrastructure was identified during the ground investigation undertaken in between 2022 and 2023. Prior to the commencement of any underground works during construction of the Project, the Applicant will undertake appropriate surveys in locations where construction works are planned, to confirm no WWU infrastructure is

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			present. This is contained within the **Outline CEMP [TR030008/APP/6.5]**.
		They also provide indications of gas pipes owned by other GTs, or otherwise privately owned, which may be present in this area. This information is not information of WWU and WWU is unable to verify this information or to confirm whether it is accurate or complete.	Prior to the commencement of any underground works during construction of the Project, the Applicant will undertake appropriate surveys to identify any such infrastructure where construction works are planned.
Second Statutory Consultation May – July 2023	The Coal Authority	Thank you for your notification of 26 May 2023 seeking the views of the Coal Authority on the above. I have checked the site location plan against our coal mining information and can confirm that, whilst the proposed development site falls within the coalfield, it is located outside the Development High Risk Area as defined by the Coal Authority. On this basis, the Planning team at the Coal Authority have no comments to make.	The comment from the Coal Authority is noted. The Coal Authority will be contacted in the event unrecorded coal mining hazards are encountered at the Site during construction of the Project.

21.3 Legislation, Policy and Guidance

21.3.1 **Table 21-2** presents the legislation, policy and guidance relevant to ground conditions and land quality, and details how their requirements have been met in the assessment.

21.3.2 At the time of scoping, the Applicant identified in the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) that planning policies within North Lincolnshire Council were potentially applicable to the assessment; however, following ongoing refinement of the Site Boundary, the Applicant can confirm that these policies are no longer relevant, and as such, these are not considered further in this chapter.

Table 21-2: Relevant legislation, policy and guidance regarding ground conditions and land quality

Legislation/Policy/Guidance	Consideration within this chapter
European Legislation	
Although the UK left the EU on 31 January 2020, the legislation in this section has been retained by the UK as specified and remains applicable to the assessment, as summarised in **Chapter 4: Legislative and Consenting Framework**.	
The Water Framework Directive (2000/60/EC) (Ref 21-31)	
The framework for community action in the field of water policy. The principal objective of the Water Framework Directive ("WFD") is for all groundwater, surface water and coastal water bodies to achieve 'good' status by 2015 and maintain this status. It includes broader ecological objectives as well as aims to prevent deterioration of all water bodies. The WFD aims to develop sustainable water use and reduce and eliminate the presence of hazardous substances within water bodies. It must be considered in any scheme that has the potential to have an impact on any part of the water environment. This is transposed into UK law by *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 21-32).*	WFD surface water bodies are described in **Section 21.6**. The potential impact to the WFD surface water bodies is outlined in **Section 21.8**.
The Groundwater Directive (2006/118/EC) (Ref 21-33)	
This Directive classifies groundwater bodies, establishes pollutant threshold values, and identifies trends and starting points for their reversal. Specific measures to control groundwater pollution are described, including good groundwater chemical status criteria and provisions to control groundwater pollutant inputs. The Directive provides further details on groundwater pollution control that are outlined within the *Water Framework Directive (2000/60/EC)*. This is transposed into UK law by *The Groundwater (Water Framework Directive) (England) Direction 2016* (Ref 21-34) and *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017* (Ref 21-32).	The WFD groundwater bodies are described in **Section 21.6**. Potential impacts to groundwater are presented in **Section 21.8**.

Legislation/Policy/Guidance	Consideration within this chapter
The Environmental Liability Directive (2004/35/EC) (Ref 21-35)	
This Directive relates to the prevention and remedying of environmental damage. The Directive refers to environmental damage to habitats and protected species, water damage (chemical and ecological) and land damage caused by land contamination. In this instance, damage is defined as "*a measurable adverse change in a natural resource or measurable impairment of a natural resource service which may occur directly or indirectly*". It also establishes a framework based on the 'polluter pays' principle to prevent and remedy environmental damage. Operators are therefore liable for the cost of prevention measures and remediation strategies. This is transposed into UK law by *The Environmental Damage (Prevention and Remediation) (England) Regulations 2015* (Ref 21-36).	Mitigation measures to prevent environmental damage caused by land contamination are presented in **Section 21.9**.
Classification Labelling & Packaging ("CLP") Regulation (2008/1272/EC) (Ref 21-37)	
The Regulation aims to ensure the environment and human health are protected through the classification and labelling of substances. The Regulation also aims to ensure free movement of substances and mixtures. This is transposed into UK law by *The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015* (Ref 21-38).	The potential impact to human health and the environment from any substances used on Site during the construction, operational and decommissioning phases of the Project, and associated mitigation measures, are presented in **Section 21.8** and **Section 21.9** respectively.
The Priority Substances Directive (2008/105/EC) (Ref 21-39)	
The Directive details the environmental quality standards (EQS) for priority substances and other pollutants provided in the WFD. The Directive aims for water bodies to achieve good surface water chemical status. This is transposed into UK law by *The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015* (Ref 21-40).	The WFD surface water bodies are described in **Section 21.6**. The WFD groundwater bodies are described in **Section 21.6**. The potential impacts to the WFD surface water bodies and groundwater bodies are outlined in **Section 21.8**.
UK Legislation	
Environmental Protection Act 1990 (Ref 21-41)	
Part 2A of the *Environmental Protection Act 1990* provides a means of dealing with unacceptable risks posed by land contamination to human health and the environment. Enforcing authorities are required to identify and deal with such land.	An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential impacts to human health and the environment are outlined in **Section 21.8**.

Legislation/Policy/Guidance	Consideration within this chapter
The Environment Act 1995 (Ref 21-42)	
The Act established the Environment Agency ("EA") and Scottish Environment Protection Agency ("SEPA") as corporate bodies. It makes provision with respect to contaminated land and abandoned mines. Further provisions relate to National Parks, pollution controls, natural resource conservation and environment conservation/enhancement.	An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential impacts to the environment from the Project are outlined in **Section 21.8.**
The Environment Act 2021 (Ref 21-43)	
The Act provides a legal framework for environmental governance and for specific improvement of the environment, including measures on waste and resource efficiency, air quality and environmental recall, water, nature and biodiversity, and nature conservation covenants.	An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. Mitigation measures to protect the environment as part of the Project are outlined in **Section 21.9**.
The Contaminated Land (England) (Amendment) Regulations 2006 (Ref 21-44)	
The Regulations set out the processes of risk assessment and identification/evaluation of remediation options. This is an amendment of the *Contaminated Land (England) Regulations, 2006 (Ref 21-45)*.	An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. The potential sources, pathways and receptors are outlined in **Section 21.6**, and the potential impacts to the receptors are discussed in **Section 21.8**.
Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref 21-46)	
The Regulations describe the legal framework for the prevention of environmental damage and requirements for remediation of damage when it occurs. It sets out the Government's views on how they should be applied and how particular terms should be interpreted.	An assessment has been undertaken to identify whether the Site poses a risk to human health and the environment. Mitigation measures to mitigate and reduce the potential impact to the environment are discussed in **Section 21.9**.
The Water Act 2003 (Ref 21-47)	
The Act provides measures with regards to holding and issuing licenses for water abstractions. The four broad aims of the Act are to ensure sustainable use of water resources, to strengthen the voice of consumers, to increase competition and to promote water conservation. The Act also considers pollution of controlled waters and coal mine water discharge and describes provisions for land drainage and flood defence. This amends the *Water Resources Act 1991* (Ref 21-48) and *Water Industry Act 1991* (Ref 21-49).	Groundwater and surface water abstractions within a 1km radius from the Site Boundary are described in **Section 21.6**. An assessment has been undertaken to identify whether the Site poses a risk to controlled waters.

Legislation/Policy/Guidance	Consideration within this chapter
The Water Act 2014 (Ref 21-50)	
The aim of the Act was to reform the water industry to make it more innovative and responsive to customers and to increase the resilience of water supplies to natural hazards such as droughts and floods. The Act includes provisions for the following: abstraction water license modifications, waterworks records, flood insurance for households, internal drainage boards, regulations for the water environment and Regional Flood and Coastal Committees.	Groundwater and surface water abstractions within a 1km radius from the Site Boundary are described in **Section 21.6**. An assessment has been undertaken to identify whether the Site poses a risk to controlled waters.
The Environmental Permitting (England and Wales) Regulations 2016 (as amended) (Ref 21-51)	
Previously under the Water Resources Act 1991 (Ref 21-48) and now under the *Environmental Permitting (England and Wales) Regulations 2016 (as amended) (Ref 21-51)* it is an offence for a person to fail to obtain, comply with or to contravene an environmental permit. The legislation provides a framework for applications for environmental permits as well as receiving, varying, transferring and surrendering permits and compliance / enforcement of permits.	An assessment has been undertaken to identify whether the Site poses a risk to controlled waters. Controlled waters are discussed in **Section 21.6**. The potential impacts to controlled waters are discussed in **Section 21.8**. Mitigation measures for controlled waters are described in **Section 21.9**.
The Land Drainage Act 1991 (as amended) (Ref 21-52)	
The Act sets out the enactments related to Internal Drainage Boards ("IDB"). The Act details the provisions for facilitating or securing land drainage, powers to modify existing obligations, financial provisions, drainage rates and duties with respect to the environment and recreation.	An assessment has been undertaken to identify whether the Site poses a risk to controlled waters. Information on drainage on the Site is provided in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**. Potential impacts to the drainage on the Site and in the study area are discussed in **Section 21.8**. Mitigation measures to protect controlled waters, including drainage, are presented in **Section 21.9**.
The Water Environment (Water Framework Directive) Regulations 2017 (Ref 21-32)	
The Water Environment Regulations 2017 implements the WFD and Groundwater Directive.	An assessment has been undertaken to identify whether the Site poses a risk to controlled waters. The WFD surface water and groundwater bodies are discussed in **Section 21.6**. The potential impact

Legislation/Policy/Guidance	Consideration within this chapter
	to surface water and groundwater are discussed in **Section 21.8**.
The Waste (England and Wales) Regulations 2011 (as amended) (Ref 21-53)	
The Regulations set out the measures required for the prevention of, production and management of waste. They describe the purpose of a waste prevention program with waste prevention measures and make reference to monitoring by appropriate authorities using qualitative or quantitative benchmarks.	Earthworks during construction will be undertaken in accordance with a Materials Management Plan ("MMP") prepared for the Project. The management of waste produced on Site is discussed in **Section 21.8**.
National Policy	
National Policy Statement for Ports ("NPSfP") (Ref 21-54)	
Section 5.1: Biodiversity and geological conservation Relevant extracts within this section of the NPSfP are: Para 5.1.4 – Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. Para 5.1.5 – The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.	The Applicant has considered the potential for the Project to affect designated geological sites. **Section 21.6** of the assessment confirms that no internationally, nationally or locally designated sites of geological conservation importance are present with the Site Boundary, and accordingly no direct or indirect effects on such interests are predicted as a result of the Project. The absence of such sites has therefore precluded the Applicant's ability to provide opportunities to conserve and enhance geological interests as part of the Project.
Section 5.6: Water quality and resources Relevant extracts within this section of the NPSfP are: Para 5.6.3 – Where the project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of, the proposed project on water quality, water resources and physical characteristics of the water environment as part of the Environmental Statement ("ES") or equivalent. Para 5.6.4 – The ES should describe: • the existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; • existing water resources affected by the proposed project and the impacts of the proposed project on water	The Applicant has considered the potential for the Project to affect water quality and water resources. **Section 21.6** present information relating to the hydrogeology within the Site Boundary, including groundwater abstractions within 1km of the Site Boundary, and information relating to WFD groundwater bodies and SPZs. **Section 21.6** present information relating to surface waters and surface water abstractions within and surrounding the Site Boundary, and information relating to WFD surface water bodies.

Legislation/Policy/Guidance	Consideration within this chapter
resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); • existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; • any impacts of the proposed project on water bodies or protected areas under the Water Framework Directive and source protection zones around potable groundwater abstractions; and • any cumulative effects.	**Section 21.6** presents information concerning existing discharges recorded within the Site, and within 500m of the Site Boundary. The predicted impacts and effects on the above interests have been assessed by the Applicant, and are presented in **Section 21.8** (where relevant to the scope of the ground conditions and land quality assessment), and in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**. Cumulative effects have been considered by the Applicant as part of the Environmental Impact Assessment process, the findings of which are reported in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.
Section 5.13: Land use including open space, green infrastructure and Green Belt Relevant extracts within this section of the NPSfP are: Para 5.13.8 – Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5), except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality, taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	The Applicant has considered the potential for the Project to affect BMV agricultural land and soils, and has sought to minimise or mitigate effects on soil resources and soil quality. A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in **Section 21.6**. The survey has confirmed that no BMV land is present within the Site Boundary. The full survey is contained within **Appendix 21.A [TR030008/APP/6.4]**. Matters relating to land contamination have been considered by the Applicant. Information concerning existing and potential sources of contamination (and their associated risks) is presented in **Section 21.6** and **Section 21.8** respectively.

Legislation/Policy/Guidance	Consideration within this chapter
National Planning Policy Framework ("NPPF") (Ref 21-55)	
The National Planning Policy Framework ("NPPF") identifies that planning decisions should recognise that some undeveloped land can perform many functions, and that substantial weight should be given to the value of using suitable brownfield land (including supporting appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land). The NPPF also identifies that planning decisions should contribute to the conservation and enhancement of the natural environment by protecting sites of geological value and soils. In relation to agricultural land, the NPPF acknowledges that where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality. The NPPF also details that planning decisions need to give regard to ground conditions and pollution, including any risks arising from land instability and risks to human health from contamination. Paragraphs 183 – 188 form part of a section called 'Ground conditions and pollution'. Paragraphs relevant to ground conditions and land quality are summarised below. Paragraph 183 details requirements of planning policies in the context of proposed development on a site including adequate site investigation, suitability in the context of ground conditions, land instability and contamination and proposals for mitigation. Paragraph 184 relates to the responsibility of developers and/or landowners for safe development. The paragraph states that the responsibility for safe development is with the developer and/ or landowner if a site is affected by land stability or contamination. Paragraph 185 refers to minimising the effects of pollution and adverse impacts from the proposed development on health, living conditions, the natural environment and sensitivity of the site.	The requirements of the NPPF have been reviewed and these have been accounted for in the assessment by undertaking studies to establish the existing conditions of the geological and soils environment, including potential contamination sources, and how these conditions may be affected by (or influence) the Project, as reported in **Sections 21.6** to **21.8**.
Planning Practice Guidance ("PPG") (revised 2021) (Ref 21-56)	
The Planning Practice Guidance ("PPG") provides supporting guidance to the NPPF. Sections of relevance to the assessment comprise: • **Land Affected by Contamination** – Ensuring a site is suitable for its new use and to prevent unacceptable risk from pollution. • **Land Stability** – The effects of land instability may result in landslides, subsidence or ground heave. Failing to deal with this issue could cause harm to human health, local property and associated infrastructure, and the wider environment.	The relevant sections of the PPG have been considered when undertaking the assessment. **Sections 21.6** and **21.8** present the baseline and assessment for ground conditions, including reference to land instability, the natural environment and potential sources of contamination.

Legislation/Policy/Guidance	Consideration within this chapter
• **Natural Environment** – A local planning authority must consult Natural England before granting planning permission for large-scale non-agricultural development on BMV land that is not in accordance with the development plan.	
Local Policy	
North East Lincolnshire Council Local Plan (Ref 21-57)	
The following policies of the NELC Local Plan are relevant to the assessment: Policy 34: Water management. This policy outlines the requirements of development proposals in relation to potential impacts to surface and groundwater. Such requirements include sustainable and adequate water supplies on site, efficient water use, adequate foul water treatment and appropriate sewerage systems. The Humber River Basin Management Plan ("RBMP") should be considered. The policy also refers to the importance of protecting groundwater within Source Protection Zones ("SPZ") during construction and operational phases.	The matters stipulated in NELC's local policies have been considered in the assessment. Information on controlled waters is provided in the baseline section in **Section 21.6**. Mitigation measures to protect controlled waters during the construction, operational and decommissioning phases are set out in **Section 21.9**.
Policy 41: Biodiversity and Geodiversity. This policy aims to retain, protect and restore biodiversity value and the ecological network. The protection and enhancement of biological and geological sites are also described within this policy. Specific reference is made to the Estuary Employment Zone which requires management to protect the biodiversity.	With specific regard to geodiversity, **Section 21.6** confirms that no internationally, nationally or locally designated sites of geological conservation importance are present with the Site Boundary.
Guidance	
Ministry of Agriculture, Fisheries and Food (1988): The Agricultural Land Classification of England and Wales: revised guidelines and criteria for grading the quality of agricultural land (Ref 21-58).	
The document provides guidance on the grading of agricultural land as part of ALC. The ALC considers the physical and chemical characteristics of land and potential limitations on agricultural land use. The grading of the land is influenced by climate, gradient, microrelief, flooding, soil properties, presence of stones, chemistry, soil wetness, moisture, and irrigation. The ALC is divided into the following grades (with BMV land represented by Grades 1, 2 and 3a): • Grade 1 is defined as excellent quality agricultural land; • Grade 2 is defined as very good agricultural land; • Grade 3a is defined as good quality agricultural land; • Grade 3b is defined as moderate quality agricultural land;	This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly in relation to the classification of different grades of agricultural soils. A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in **Section 21.6**. The survey has confirmed that no BMV land is present within the Site Boundary.

Legislation/Policy/Guidance	Consideration within this chapter
• Grade 4 is defined as poor quality agricultural land; • Grade 5 is defined as very poor-quality agricultural land; and • Grade Urban is defined as built-up land / 'hard' uses such as industrial land, housing, commercial land, education, transport, cemeteries, religious buildings, permanent caravan sites, derelict land and hard-surfaced sports facilities. Grade Urban land is considered unlikely to return to an agricultural land use.	The full survey is contained within **Appendix 21.A [TR030008/APP/6.4]**.
Natural England (2012) Technical Information Note TIN049 Agricultural Land Classification: Protecting the best and most versatile agricultural land (Ref 21-59)	
The Technical Information Note discusses the ALC criteria and guidelines in a shorter format compared to the Ministry of Agriculture, Fisheries and Food (1988) document. The methodology for the ALC field survey is outlined and information regarding consultation with Natural England is summarised.	This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly the methodology for undertaking the ALC survey within the Site Boundary. A detailed ALC survey has been undertaken, to identify any areas of BMV land within the Site Boundary, the findings of which are summarised in **Section 21.6**. The survey has confirmed that no BMV land is present within the Site Boundary. The full survey is contained within **Appendix 21.A [TR030008/APP/6.4]**.
IEMA Guide: A New Perspective on Land and Soil in Environmental Impact Assessment (Ref 21-60)	
The IEMA guide provides information on the consideration of the effects of proposed developments on soil within EIA including soil function, soil handling during all phases of the proposed development and sustainable soil use of soils.	This guidance has been considered when undertaking the assessment of the impacts and effects of the Project on BMV land, particularly in relation to identifying soil grades, classifications and chemistry. This guidance has also informed the identification of appropriate mitigation measures for soil handling and management during the construction phase of the Project. Soil classification within the Site Boundary has been evaluated and is presented in **Section 21.6**. Impacts and effects on soil are summarised in **Table 21-18**. Mitigation measures

Legislation/Policy/Guidance	Consideration within this chapter
	for soil resources are presented in **Section 21.9**.
Building Research Establishment ("BRE") Special Digest 1:2005, Third Edition, Concrete in Aggressive Ground, 2005 (Ref 21-67)	
The BRE Sulphate assessment gives guidance on designing foundation and infrastructure that would be prone to a sulphate attack from materials within the ground.	This guidance has been considered when undertaking a BRE Sulphate assessment, which has been carried out as part of a wider ground investigation at the Site that has examined potential ground hazards and risks. Key outcomes of the ground hazards assessment are presented in **Section 21.6**.
Joint Industry Working Group (JIWG) CAR-SOIL Guidance, July 2016 (Ref 21-68)	
This document has been prepared with the support of the Health and Safety Executive and presents the definitive explanation of how the legal requirements of the Control of Asbestos Regulations 2012 (CAR 2012 Regulations) have been interpreted to apply to work with asbestos contaminated soil and construction & demolition materials. The guidance is underpinned by the fundamental requirements expressed in the Regulations, in relation to the protection of employees from risks related to exposure to asbestos, but is set within a carefully considered framework designed specifically for soil and materials contaminated with asbestos.	This guidance has been considered when undertaking an asbestos assessment, which has been carried out as part of a wider ground investigation at the Site. Key outcomes of the asbestos assessment are presented in **Section 21.8**.
CIRIA C665, Assessing risks posed by hazardous ground gases to buildings, London 2007 (Ref 21-69)	
This guidance aims to ensure a consistent approach to decision making, particularly with respect to the need for, and scope of, remedial/protective design measures while remaining flexible enough to be relevant to site-specific and development variabilities.	This guidance when undertaking a gas risk assessment, which was carried out as part of a wider ground investigation at the Site. Key outcomes of the gas risk assessment are presented in **Section 21.6**.

21.4 Assessment Methodology and Significance Criteria

21.4.1 The assessment has followed the methodology and approach presented in Section 20.6 of the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**).

21.4.2 The methodology has diverged from the generic assessment approach to identifying receptor sensitivity and magnitude of impact outlined in **Chapter 5: EIA Process [TR030008/APP/6.2]**, and accordingly has applied the assessment criteria defined in the Design Manual for Roads and Bridges ("DMRB") LA 104

Environmental Assessment and Monitoring (Ref 21-4), DMRB LA 109 Geology and Soils (Ref 21-2) and DMRB LA 113 Road Drainage and the Water Environment (Ref 21-3).

21.4.3 Receptor sensitivity reflects the quality of a receptor and its ability to absorb an effect without perceptible change. The sensitivity of the receptor is defined using the criteria and descriptors within DMRB LA 109 (Ref 21-2) and DMRB LA 113 (Ref 21-3).

Table 21-3: Sensitivity of Receptors

Sensitivity/Value	Description Criteria	Typical Examples
Very High	Geology Very rare and of international importance with no potential for replacement.	United National Educational, Scientific and Cultural Organisation ("UNESCO") World Heritage Sites Site of Special Scientific Interest ("SSSI") and Geological Conservation Review ("GCR") of international importance and or UNESCO Global Geoparks.
	Soils Soils directly supporting an EU designated site or agricultural land.	Special Area of Conservation ("SAC"), Special Protection Area ("SPA"), Ramsar; and/or ALC Grade 1 and 2 or Land Capable for Agriculture ("LCA") Grade 1 and 2.
	Contamination Human health: very high sensitivity.	Very high sensitivity land use (e.g. residential).
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourse having a WFD classification shown in a River Basin Management Plan ("RBMP") and Q95 ≥ 1. 0 m^3/ s. Site protected/designated under EC or UK legislation (SAC, SPA, SSSI) Ramsar site, salmonid water/species protected by EC legislation.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Principal aquifer providing a regionally important resource and/ or supporting a site protected under EC and UK legislation Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems ("GWDTE") SPZ1
High	Geology Rare and of national importance with little potential for replacement.	Rare and of national importance with little potential for replacement (e.g. GCR, SSSI, Areas of Special Scientific Interest ("ASSI"), National Nature Reserves ("NNR")).

Sensitivity/Value	Description Criteria	Typical Examples
		Geology meeting national designation citation criteria which is not designated as such.
	Soils Soils directly supporting an EU designated site or agricultural land.	Soils directly supporting a UK designated site (e.g. SSSI); and/or ALC Grade 3a, or LCA Grade 3.1.
	Contamination Human health: very high sensitivity;	High sensitivity land use such as public open space.
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourse having a WFD classification shown in a RBMP and Q95 <1.0m^3/ s. Species protected under EC or UK legislation.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ2.
Medium	Geology Of regional importance with limited potential for replacement. Geology meeting regional designation citation criteria which is not designated as such.	Local Geological Sites (“LGS”) (formerly Regionally Important Geological Sites (“RIGS”)
	Soils Soils supporting non-statutory designated sites.	Local Nature Reserves (“LNR”), LGSs, Sites of Nature Conservation Importance (“SNCIs”); and/ or ALC Grade 3b or LCA Grade 3.2.
	Contamination Human health: medium sensitivity;	Medium sensitivity land use such as commercial or industrial.
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water	Watercourses not having a WFD classification shown in a RBMP and Q9 5 >0.001m^3/ s.

Sensitivity/Value	Description Criteria	Typical Examples
	environment DMRB LA113 (Ref 21-3).	
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ3
Low	Geology Of local importance/ interest with potential for replacement	Non designated geological exposures, former quarries/mining sites
	Soils Soils supporting non-designated notable or priority habitats	ALC Grade 4 and 5 or LCA Grade 4.1 to 7
	Contamination Human health: Low sensitivity;	Low sensitivity land use such as highways and rail.
	Surface water Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Watercourses not having a WFD classification shown in a RBMP and Q9 5 ≤0.001m^3/ s.
	Groundwater Relevant sensitivity criteria from Table 3.70 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Unproductive strata
Negligible	Geology No geological exposures, little/no local interest.	
	Soils Previously developed land formerly in 'hard uses' with little potential to return to agriculture.	
	Contamination Human health: Undeveloped surplus land/ no sensitive land use proposed.	
	Surface water and groundwater	

Sensitivity/Value	Description Criteria	Typical Examples
	There is no sensitivity rating for negligible described in DMRB LA 113 (Ref 21-3).	

21.4.4 The magnitude of impacts has considered the scale of the predicted change to the baseline conditions, taking into account its duration (i.e. the magnitude may be moderated if they are temporary rather than permanent, or short term rather than long term).

21.4.5 Impacts can be direct or indirect in nature:

a. Direct impacts, for example, could comprise the accidental release of contaminants during construction and/or operation. Similarly, direct impacts could comprise the loss of agriculturally viable soils to accommodate new development.

b. Indirect effects, for example, could involve the disturbance of the ground in a way that contaminant linkages (source-pathway-receptor) are created, such as opening a pathway for the migration of a pollution plume within Made Ground into aquifers. Similarly, indirect impacts could comprise the migration of potentially contaminated material offsite to properties at distance from the construction source.

21.4.6 The magnitude of impact has been defined using DMRB LA 109 (Ref 21-2) and DMRB LA 113 (Ref 21-3) as outlined in **Table 21-4**.

Table 21-4: Magnitude of Impacts

Magnitude	Criteria	Typical Examples
Major (DMRB LA 109) (Ref 21-1)	Geology Loss of geological feature/ designation and/ or quality and integrity, severe damage to key characteristics, features or elements.	Destruction of features at a protected site i.e. SSSIs of international importance; or Global Geoparks.
	Soils Physical removal or permanent sealing of soil resource or agricultural land.	N/A
	Contamination Human Health: significant contamination identified.	Contamination levels significantly exceed background levels and relevant screening criteria (e.g. category 4 screening levels) Standard Procedure (SP)1010 with potential for significant harm to human health. Contamination heavily restricts future use of land.
Major Adverse (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and	Failure of both acute-soluble and chronic-sediment related pollutants in Highways England's Water Risk Assessment Tool ("HEWRAT") and

Magnitude	Criteria	Typical Examples
	water environment DMRB LA113 (Ref 21-3).	compliance failure with Environmental Quality Standards ("EQS") values. Calculated risk of pollution from a spillage ≥2% annually (spillage assessment). Loss or extensive change to a fishery. Loss of regionally important public water supply (spillage assessment). Loss of regionally important public water supply (non-spillage assessment). Loss or extensive change to a designated nature conservation site. Reduction in water body WFD classification.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Loss of, or extensive change to, an aquifer. Loss of regionally important water supply. Potential high risk of pollution to groundwater from routine runoff - risk score >250 (Groundwater quality and runoff assessment). Calculated risk of pollution from spillages ≥2% annually (spillage assessment). Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies. Reduction in water body WFD classification. Loss or significant damage to major structures through subsidence or similar effects.
Major Beneficial (DMRB LA113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA113 (Ref 21-3).	Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring to a watercourse. Improvement in water body WFD classification.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer.

Magnitude	Criteria	Typical Examples
		Improvement in water body WFD classification.
Moderate (DMRB LA 109) (Ref 21-1)	Geology Partial loss of feature/designation, potentially adversely affecting integrity; partial loss of/ damage to key characteristics, features or elements.	Partial loss of features at a protected site i.e. SSSIs; NNRs.
	Soils Permanent loss/reduction of one or more soil function(s) and restriction to current or approved future use (e.g. through degradation, compaction, erosion of soil resource.)	N/A
	Contamination Human health: contaminant concentrations exceed background levels and are in line with limits of relevant screening criteria (e.g. category 4 screening levels) SP1010.	Significant contamination can be present. Control/remediation measures are required to reduce risks to human health/make land suitable for intended use.
Moderate Adverse (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Failure of both acute-soluble and chronic-sediment related pollutants in HEWRAT but compliance with EQS values. Calculated risk of pollution from spillages ≥1% annually and <2 % annually. Partial loss in productivity of a fishery. Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies. Contribution to reduction in water body WFD classification.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Partial loss or change to an aquifer. Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies. Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250.

Magnitude	Criteria	Typical Examples
		Calculated risk of pollution from spillages ≥1% annually and <2 % annually. Partial loss of the integrity of GWDTE. Contribution to reduction in water body WFD classification. Damage to major structures through subsidence or similar effects or loss of minor structures.
Moderate Beneficial (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	HEWRAT assessment of both acute-soluble and chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually). Contribution to improvement in water body WFD classification.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually). Contribution to improvement in water body WFD classification. Improvement in water body Catchment Abstraction Management Strategy ("CAMS") (or equivalent) classification. Support to significant improvements in damaged GWDTE.
Minor (DMRB LA 109) (Ref 21-1)	Geology Minor measurable change in geological feature/designation attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.	Minor measurable change of features at Geological sites; i.e. RIGS.
	Soils Temporary loss/ reduction of one or more soil function(s) and restriction to current or approved future use.	Through degradation, compaction or erosion of soil resource.
	Contamination Human health: contaminant concentrations are below relevant	Significant contamination is unlikely with a low risk to human health.

Magnitude	Criteria	Typical Examples
	screening criteria (e.g. category 4 screening levels) SP1010.	Best practice measures can be required to minimise risks to human health.
Minor Adverse (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Failure of either acute soluble or chronic sediment related pollutants in HEWRAT. Calculated risk of pollution from spillages ≥0.5% annually and < 1% annually. Minor effects on water supplies.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	Potential low risk of pollution. to groundwater from routine runoff - risk score <150 Calculated risk of pollution from spillages ≥0.5% annually and <1% annually. Minor effects on an aquifer, GWDTEs, abstractions and structures.
Minor Beneficial (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	HEWRAT assessment of either acute soluble or chronic-sediment related pollutants becomes pass from an existing site where the baseline was a fail condition. Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually).
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment LA113 (Ref 21-3).	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually). Reduction of groundwater hazards to existing structures. Reductions in waterlogging and groundwater flooding.
Negligible (DMRB LA 109) (Ref 21-1)	Geology Very minor loss or detrimental alteration to one or more characteristics, features or elements of geological feature/ designation. Overall integrity of resource not affected.	Very minor change of features at sites of local importance, i.e. non-designated geological sites.
	Soils	N/A

Magnitude	Criteria	Typical Examples
	No discernible loss/ reduction of soil function(s) that restrict current or approved future use.	
	Contamination Human health: contaminant concentrations substantially below levels outlined in relevant screening criteria (e.g. category 4 screening levels) SP1010	No requirement for control measures to reduce risks to human health/ make land suitable for intended use.
Negligible (DMRB LA 113) (Ref 21-3)	Surface water: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA113 (Ref 21-3).	No risk identified by HEWRAT (pass both acute-soluble and chronic-sediment related pollutants). Risk of pollution from spillages <0.5%.
	Groundwater: relevant sensitivity criteria from Table 3.71 in Road drainage and water environment DMRB LA 113 (Ref 21-3).	No measurable impact upon an aquifer and/ or groundwater receptors and risk of pollution from spillages <0.5%.

21.4.7 The significance of effect matrix diverges from the generic significance evaluation matrix presented in **Chapter 5: EIA Process [TR030008/APP/6.2]**, and follows the guidance in DMRB LA 104 (Ref 21-4), as presented in **Table 21-5**.

Table 21-5: Significance Evaluation Matrix

		Magnitude of Impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity of Receptor	**Very high**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
Note: Where the significance of an effect is represented by two descriptors, for example large/very large within the matrix, professional judgement has been used to determine which of the significance descriptors applies to the effect being assessed.						

21.4.8 Significant effects comprise those effects that are within the moderate, large or very large categories, in accordance with DMRB LA 104 (Ref 21-4).

21.4.9 The assessment of effect significance has taken into account the effectiveness of both embedded mitigation and standard mitigation measures, as these comprise measures that would be delivered as an integral component of the design of the Project and through the application of best practice construction techniques during its construction.

21.4.10 Where the assessment has identified that effects are significant after taking account of both embedded and standard mitigation measures, additional mitigation measures have been identified to reduce their significance (where possible) in line with the approach described in **Chapter 5: EIA Approach [TR030008/APP/6.2]**.

21.4.11 A confidence level using a scale of Low-Medium-High has been included against each reported residual effect to reflect the confidence in the reported conclusions.

Limitations and Assumptions

21.4.12 The information presented in this chapter reflects that obtained and evaluated at the time of assessment and is based on the proposed parameters for the Project described in **Chapter 2: The Project [TR030008/APP/6.2]**, in accordance with the principles of the Rochdale Envelope.

21.4.13 The assessment has been undertaken with reference to the data, information and records pertaining to the baseline environment (derived from desk-based sources). As the assessment relies to an extent on the interpretation of third-party data and reports, it has been assumed that such information is accurate and a true reflection of the conditions it describes.

21.4.14 Site-based surveys comprising Ground Investigations and an ALC survey have been carried out at locations within the Site Boundary:

a. At the time of carrying out the ALC survey, access was only possible to the western part of the arable field forming the Laporte Road Temporary Construction Area (Work No.9). For the purposes of carrying out the assessment, it has been assumed that the eastern part of this arable field would be classed in the same way (i.e. as Grade 3b) based on the assumption that the field in its entirety is being farmed in the same way. Further details of the ALC survey are presented in **Appendix 21.A [TR30008/APP/6.4]**.

b. A Ground Investigation has been undertaken to assess the presence of contamination at the Site and determine the impacts this may have on Site users and the environment, the findings of which have been used to inform the identification of appropriate standard mitigation measures (for example remediation). If, during development, any previously unidentified contamination is encountered, an appropriate investigation to allow sampling and testing of materials and risk assessment will be undertaken. Any actions resulting from the risk assessment will be agreed with the local planning authority along with any remedial measures in consultation with the

Environment Agency, where risks to controlled waters are identified. The Outline Remediation Strategy (**Appendix 21.C [TR030008/APP/6.4])** sets out steps that would be undertaken where previously unidentified contamination is discovered. Any actions required will be agreed with the planning authority and Environment Agency.

21.5 Study Area

21.5.1 Based on the types of receptor that could potentially be affected by the Project and the geographical area over which potential direct and indirect impacts could occur, the following study areas have been adopted in the assessment. Their definition has been informed by a combination of professional judgement, established industry practice and a review of the areas originally defined at the scoping stage (as described in **Appendix 1.A [TR030008/APP/6.4]**):The study area for the majority of the assessment has been defined as the entirety of the land within the Site Boundary, along with a buffer extending 500m around this area to identify potential off-site sources of contamination and land stability issues. This includes any artificial land, geological deposits underlying artificial ground and any natural ground underlying surface water bodies (defined as the '500m study area').

b. For the assessment of effects to controlled waters (including groundwater abstractions and groundwater SPZs), a larger buffer including and extending outward by 1km from the Site Boundary has been applied to enable consideration of possible migration pathways over longer distances (defined as the '1km study area').

c. For the assessment of agricultural soils, the study area has focused on existing land within the Site Boundary only. The ALC survey comprised evaluation of two parcels of mostly agricultural land, Works No.s 7 and 9, located to the west and east of the Site. The land within Works No.7 is former agricultural fields which have been abandoned and is currently zoned for light industrial use, for which there is an extant planning permission.

d. For the Ground Investigation, the area of investigation comprised Work No.s 3 East Site- Storage, 4 Laporte Road Culvert, 5 East Site – Hydrogen Production, 6 Pipeline Corridor and 7 West Site.

21.5.2 The extents of the Site Boundary are shown on **Figure 1.1** and **Figure 2.3 [TR030008/APP/6.3]**.

21.6 Baseline Conditions

Current Baseline

Data and Information Sources

21.6.1 The current baseline conditions within the adopted study areas of 500m and 1km have been identified within the assessment using data within published material and records from a range of sources, and environmental information gathered through Site surveys, as summarised in **Table 21-6**.

Table 21-6: Data and Information Sources

Topic	Data Source
Geological Data	British Geological Survey GeoIndex Online (Ref 21-15) British Geological Survey Solid and Drift for Partington (Sheet 81 (and including parts of Sheet 82 and 90) 1:50,000 (Ref 21-6) British Geological Survey Lexicon of Named Rock Units (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
Soils and Agricultural Land	Cranfield Soil and Agrifood Institute Soilscapes (Ref 21-11) Provisional Agricultural Land Classification Grade map on the Department for the Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref 21-13) ALC Survey reported in **Appendix 21.A Agricultural Land Classification Survey Report [TR030008/APP/6.4]**
Coal Mining	Coal Authority Interactive Map Viewer (Ref 21-12)
Environmental and Groundwater Data	Data and records held on the MAGIC website (Ref 21-13) Groundsure Report Enviro+Geo Insight Report (GS-9009838) (Ref 21-16)
Surface Water	Environment Agency (“EA”) Catchment Data Explorer (Ref 21-14)
Historic and Current Land Uses	Google Maps website (Ref 21-15)
Geotechncial Desk Studies and Risk Assessments	Immingham Green Energy Terminal Phase 1 Geo-environmental and Geotechnical Desk Study (AECOM, 2022) (Ref 21-63) AECOM. (2022). Immingham NH3 Import Terminal. Development Appraisal Report (Ref 21-17)
Ground Investigations	Geotechnical Engineering Limited (supervised by AECOM) at the East Site and West Site (Work No.s 3, 4, 5 and 7) from November 2022 to February 2023 (Ref 21-70) RSK Ground Investigation undertaken in 2020 within the Pipeline Corridor and Queens Road Temporary Construction Area (Work No.s 6, 7 and 8) - RSK (2020) Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation (Ref 21-18)

Statutory and Non-Statutory Designed Sites and Features

21.6.2 Based on the designation, the following statutory and non-statutory designated sites are located within and/or surrounding the Site Boundary, as defined by the 500m study area:

a. The north-eastern extents of the Site within the marine environment are located within the Humber Estuary, which is designated as a Ramsar site; a SSSI; a SAC; and a SPA.

b. The Site is located within a SSSI Impact Risk Zone, and the bank of the Humber Estuary within the Site is classified as 'unfavourable – recovering', based on information contained within the Groundsure Report (GS-9009838) (Ref 21-16).

c. The Site is located within a Nitrate Vulnerable Zone associated with the North Beck Drain, as shown on **Figure 21.3 [TR030008/APP/6.3]**.

21.6.3 No designated sites of international, national or local geological conservation importance are located inside, or within 500m of, the Site.

21.6.4 There are no geological faults recorded inside, or within 500m of, the Site.

Soils and Agricultural Land Classification

21.6.5 Data held in the Cranfield Soilscapes (Ref 21-11) describes the soils beneath the Site as "loamy and clayey soils of coastal flats with naturally high groundwater", with naturally wet drainage and lime rich to moderate fertility, and notes that the "water resource is vulnerable to pollution from nutrients, pesticides and wastes applied to the land".

21.6.6 The BGS Estimated Background Soil Chemistry for the Site is recorded as the following, based on information contained within the Groundsure Report (GS-9009838) (Ref 21-16):

a. Arsenic 15-25mg/kg

b. Lead 100mg/kg

c. Cadmium 1.8mg/kg

d. Chromium 90-120mg/kg

e. Nickel 30-45mg/kg

21.6.7 Using the ALC system, agricultural land in England is graded between 1 and 5 (depending on the extent to which physical or chemical characteristics impose long-term limitations on agricultural use):

a. Grade 1 land is excellent quality agricultural land with very minor or no limitations to agricultural use.

b. Grade 2 is very good quality agricultural land, with minor limitations which affect crop yield, cultivations or harvesting.

c. Grade 3 land has moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield, and is subdivided into Subgrade 3a (good quality land) and Subgrade 3b (moderate quality land).

d. Grade 4 land is poor quality agricultural land with severe limitations which significantly restrict the range of crops and/or level of yields.

e. Grade 5 is very poor quality land, with very severe limitations which restrict use to permanent pasture or rough grazing.

21.6.8 Land which is classified as Grades 1, 2 and 3a in the ALC system is defined as BMV agricultural land.

21.6.9 The ALC gradings for the Site are summarised in **Table 21-7**. The gradings have been established based on a combination of information within the Provisional Agricultural Land Classification Grade map (Ref 21-13) and the findings of the ALC survey reported in **Appendix 21.A [TR030008/APP/6.4]**.

Table 21-7: Summary of ALC Gradings for the Site

Location	ALC Grade (Ref 21-13)	ALC Survey Results
East Site (Work No. 3, 4, 5)	The East Site is designated as Grade Urban.	No survey undertaken.
West Site (Work No. 7).	Most of the West Site is designated as Grade 3. The land has not been subdivided into Grades 3a or 3b. A small area of land parallel to and including the properties on Queens Road is designated as Grade Urban	The ALC Survey indicates the West Site is designated as Grade 3b. However, Works No.7 is no longer farmed and is currently zoned for light industrial use, for which there is an extant planning permission.
Pipeline Corridor, Jetty Access and Pipe-Rack Corridor and Queens Road Temporary Construction Area (Work No. 2, 6 and 8)	The Pipeline Corridor and Jetty Access Road Corridor are designated as Grade Urban.	No survey undertaken.
Laporte Road Temporary Construction Area (Work No. 9)	The eastern half of the Laporte Road Temporary Construction Area is designated as Grade 3, but not subdivided into Grades 3a or 3b, and the western half is designated as Grade Urban	The ALC Survey within the thin strip of land in the Laporte Road Temporary Construction Area, adjacent to the Jetty Access and Pipe-Rack Corridor, indicates the land is classified as Grade 3b.
Temporary removal of Kings Road street furniture and overhead cables (Work No.10)	Kings Road is designated as Grade Urban	No survey undertaken

Geology

21.6.10 The geology beneath the Site is shown on the BGS GeoIndex (Onshore) Map (Ref 21-1), BGS 1;50,000 Sheet 81 (and including parts of Sheets 82 and 90) (Partington) (Ref 21-6) and on the 1:50,000 Geology Maps provided as part of the Groundsure Report (GS-9009838) (Ref 21-16).

21.6.11 **Table 21-8** provides a detailed summary of the anticipated geology beneath the Site and a summary of the description provided on the BGS Lexicon of Named Rock Units (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10). **Figures 21.1** and **21.2 [TR030008/APP/6.3]** illustrate the geology beneath the Site.

Table 21-8: Published Geology

Stratum		Expected Location	Description (BGS Lexicon) (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
Artificial	Made Ground (Undivided) Artificial Deposit	Made Ground (Undivided) is shown on the BGS GeoIndex in the western half of the East Site (Work No. 3, 3-A, 4, 5 and 5-A) and in the central area of the Pipeline Corridor (Work No. 6). Although it is not mapped across most of the Site, Made Ground is anticipated to be present across the majority of the Site.	Made Ground is described as "*an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified. Variable composition*".
Superficial Deposits	Beach and Tidal Flat Deposits (Clay, Silt and Sand)	Northeastern boundary of the Site (Jetty Access and Pipe-Rack Corridor and Laporte Road Temporary Construction Area in the northeast) of the Site (Work No. 2 and 9), along the bank of the Humber Estuary.	Beach and Tidal Flat Deposits are described as "*composite of 'Beach deposits': Shingle, sand, silt and clay; may be bedded or chaotic; beach deposits may be in the form of dunes, sheets or banks, and 'Tidal Flat Deposits': commonly silt and clay with sand and gravel layers; possible peat layers; from the tidal zone*".
	Tidal Flat Deposits (Clay and Silt)	Entire Site, apart from the bank of the Humber Estuary.	Tidal Flat Deposits are described as "*unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat*".
	Devensian Till (Diamicton)	Entire Site, underlying the Tidal Flat Deposits.	There is no description on the BGS Lexicon of Named Rock Units. Till usually comprises clay, sand, gravel and boulders.
Bedrock	Flamborough Chalk Formation	The BGS GeoIndex (Ref 21-5) indicates the Flamborough Chalk Formation is present beneath most of the Site at Work No's 3, 5, 6, 8 and 9, underlying the Devensian Till. However, the BGS Sheet 81 for Patrington 1:50,000 Map (Ref 21-6) indicates that the Flamborough Chalk Formation is present across most of the Site, apart from a thin strip along the western boundary of the West Site (Work No. 7).	The Flamborough Chalk Formation is described as "*White, well-bedded, flint-free chalk with common marl seams (typically about one per metre). Common stylolitic surfaces and pyrite nodules*".

Stratum		Expected Location	Description (BGS Lexicon) (Ref 21-7, Ref 21-8, Ref 21-9 and Ref 21-10)
	Burnham Chalk Formation	The Burnham Chalk Formation underlies the Flamborough Chalk Formation across the entire Site and underlies the western boundary of the West Site (Work No.7). Kings Road Work No.10 is underlain by the Burnham Chalk Formation.	The Burnham Chalk Formation is described as "*white, thinly-bedded chalk with common tabular and discontinuous flint bands; sporadic marl seams*".

21.6.12 The Groundsure Report (GS-9009838) (Ref 21-16) indicates the minimum permeability of the superficial deposits is very low, and the maximum permeability varies between low and moderate. The moderate permeability may be associated with the Beach and Tidal Flat Deposits, although this has not been confirmed. The pattern of groundwater flow in the superficial deposits is recorded as intergranular. The minimum and maximum permeability of the chalk bedrock is designated as very high, although the range of permeability may vary by one or two orders of magnitude. The groundwater flow pattern is recorded as being via fractures which is commonly considered to result from the presence of a network of interconnected joints and fissures in the chalk strata.

21.6.13 There are seventeen BGS boreholes located inside, and within 5m of, the Site Boundary. Of the seventeen BGS boreholes, fourteen had accessible borehole records: TA11SE152, TA11SE151, TA21SW278, TA21SW91, TA21NW16, TA21NW18, TA21NW17, TA21NW20, TA21NW3/C, TA21NW3/A, TA21NW3/D, TA21SW338, TA11SE32 and TA21SW92. A summary of the geology encountered within these BGS boreholes is provided in **Table 21-9.**

Table 21-9: Summary of encountered strata in BGS boreholes

Strata	Minimum Depth (m below ground level (bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
West Site (Work No. 7)				
Soil	0.0	0.3	0.3	-
Clay	0.0	15.24	1.5**– 6.5**	-
Warp	0.3	6.4	4.88 – 6.1	-
Peat	2.9	7.62	0.1 – 1.22	-
Silt	7.62	15.09	0.15 – 0.61	-
Gravel	5.18	5.79	0.61*	-
Boulder Clay	7.77	18	2.89 – 7.17	-

Strata	Minimum Depth (m below ground level (bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
Sand	10.97	11.58	0.61*	-
Chalk***	15.24	25.3**	3.28** – 4.88**	-
Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8)				
Soil	0	1.6	1.3 – 1.6	-
Silt	0	7.92	2.75*	-
Warp	0	9.14	7.16 – 9.14	-
Clay	1.3	19.6	10.37 – 18.3	A water strike was recorded at 16.5m bgl in TA21NW17.
Peat	7.16	7.92	0.46 – 0.6	-
Marl	7.62	20.42	12.8*	-
Clay and Marl	20.42	27.43	7.01	-
Clay and Silt	16.8	18.6	1.8*	-
Gravel	17.1	22.6	3 – 4.3	A water strike was recorded at 18.6m bgl in TA21NW17.
Chalk***	16.46	32.6**	4.9** – 10.8**	-
East Site (Work No. 3, 4, 5)				
Warp	0	9.14	8.84 – 9.14	The rest level of groundwater was recorded at the ground surface in TA21NW3/D.
Silt	0	10.96**	0.42 – 8.06	-
Sand	8.06	18.59	0.05 – 0.61	-
Peat	8.84	9.83	0.09 – 0.61	-
Clay	9.14	20.12	1.22 – 10.37	-
Chalk***	19.51	33.83	10.97** - 13.71**	-

Strata	Minimum Depth (m below ground level (bgl)	Maximum Depth (m bgl)	Thickness Range (m)	Groundwater Strikes (m bgl)
Laporte Road Temporary Construction Area* (Work No. 9)				
Warp	0	8.84	8.84	-
Peat	8.84	9.14	0.3	-
Boulder Clay	9.14	18.9	1.53 – 7.62	-
Sand	16.76	17.37	0.61	-
Gravel	18.9	21.03	2.13	-
Clay	21.03	25.3	4.27	-
Chalk	25.3	31.4**	6.1**	-

*Only encountered in one borehole
**Depth to base not proven
***The handwriting on the borehole logs was not clear for Chalk stratum. The handwriting may allude to 'Chalk Bearings' which are referred to in the BGS Chalk Aquifer System of Lincolnshire Research Report (Ref 21-30), however, this is not clear. This summary has been included within Chalk.
****The borehole log only stated 'Bd'. The strata cannot be determined but is likely to relate to boulder clay based on the published geological maps and nearby boreholes.

Ground Stability Hazards

21.6.14 The Groundsure Report (GS-9009838) (Ref 21-16) presents information on the ground stability hazards at the Site.

21.6.15 The Tidal Flat Deposits on the Site are associated with a Low shrink swell clay ground stability hazard. The Beach and Tidal Flat Deposits on the banks of the Humber Estuary within the Site Boundary are associated with a *Very Low* shrink swell clay ground stability hazard.

21.6.16 The areas of the Site that are mapped as Made Ground on the BGS 1:50,000 Artificial Map (Ref 21-5) are associated with a *Very Low* running sands and compressible ground stability hazards, and the remaining areas of the Site are classified as a *Moderate* hazard.

21.6.17 The Site has been classified as a *Negligible* risk for collapsible ground stability hazards and ground dissolution hazards, and has been classified as a *Very Low* risk associated with landslide ground stability hazards.

Ground Investigations

21.6.18 To establish the baseline and inform the design and ground assessment for the Project, three Ground Investigations ("GIs") have been undertaken. The first Ground Investigation delivered in 2020 by RSK, was carried out within the Pipeline Corridor and Queens Road Temporary Construction Area (Works No.s 6, 7 and 8). A second Ground Investigation was undertaken from November 2022

to March 2023, by Geotechnical Engineering Limited (supervised by AECOM). The purpose of this Ground Investigation was to assess the ground to inform design at the West Site and East Site (Works No.s 3,4,5 and 7). The third Ground Investigation was undertaken along the Pipeline Corridor (Works No. 6) from May 2023 to June 2023 by Geotechnical Engineering Limited. Ground Investigations are scheduled to take place in the Pipe Rack and Jetty Access Road (Work No. 2) in Q4 2023

21.6.19 Ground Investigations covering the Pipeline Corridor (Work No. 6), Pipe Rack and Jetty Access Road (Work No. 2) are ongoing and the data from these investigations was not available for inclusion. The assessment presented in this chapter therefore makes realistic worst-case assumptions about the likely material present in these areas.

Geotechnical Engineering Limited: Ground Investigation November 2022 to February 2023

21.6.20 A Ground Investigation was undertaken by Geotechnical Engineering Limited (supervised by AECOM) in the West Site (Work No. 7) and East Site (Work No. 3, 3-A, 4, 5 and 5-A) between 8 November 2022 and 16 February 2023.

21.6.21 The purpose of this investigation was to inform the design of the Project, and information gathered has been used to assist the establishment of baseline conditions at the Site and to inform the assessment of the Project's impacts and effects. This has included chemical and geotechnical data (via site and laboratory testing) from across the Site, to be able to develop a Conceptual Site Model (CSM) and provide adequate, good quality data for undertaking human health, controlled waters and ground gas risk assessments.

21.6.22 The findings of this Ground Investigation, including the CSM, are provided in **Appendix 21.B [TR030008/APP/6.4]**.

21.6.23 A summary of the strata encountered within the West Site (Work No. 7) during the ground investigation is presented in **Table 21-10**.

Table 21-10: Strata encountered at Work No. 7

Strata	Depth Encountered	Thickness Range
Topsoil	Ground level	01m to 0.6m
Made Ground	Ground Level	0.25m to 2.1m
Firm Tidal Flat Deposits	Between 0.15m bgl and 1.3m bgl	0.2m to 2.5m
Tidal Flat Deposits	Between 0.25m bgl and 10m bgl	0.4m to 11.7m
Glacial Till Deposits	Between 4.2m bgl and 10.6m bgl	6.5m to 17.6m
Granular Till Deposits	Between 12.5m bgl and 18.72m bgl	0.1m to 2.62m
Weathered Flamborough Chalk	Between 18.4m bgl and 22.5m bgl	0.46m to 8.9m

Strata	Depth Encountered	Thickness Range
Flamborough Chalk	Between 23.16m bgl and 30.65m bgl	0.85m and 4m (proven)

21.6.24 A summary of the strata encountered within the East Site Hydrogen Production Site (Work No. 5 and 5-A) is presented in **Table 21-11.**

Table 21-11: Strata encountered at Work No. 5 and 5A

Strata	Depth Encountered	Thickness Range
Made Ground	Ground Level	0.35m to 4m
Firm Tidal Flat Deposits	Between 0.4m bgl and 3m bgl	Up to 2.3m
Tidal Flat Deposits	Between 1.2m bgl and 4.6m bgl	0.3m to 11.4m
Glacial Till Deposits	Between 6.14m bgl and 14.2m bgl	5.3m to 14.15m
Granular Glacier Till Deposits	Between 15.4m bgl and 20.8m bgl	0.12m to 3.4m
Weathered Flamborough Chalk	Between 23.35m bgl and 27.75m bgl	0.25m to 4.6m
Flamborough Chalk	Between 23.16m bgl and 30.65m bgl	0.85m and 4m (proven)

21.6.25 A summary of the strata encountered in the East Site Ammonia Storage Site (Work No. 3, 3A) and Laporte Road Culvert (Work No. 4) is presented in **Table 21-12**.

Table 21-12: Strata encountered at Work No's. 3, 3A and 4

Strata	Depth Encountered	Thickness Range
Made Ground	Ground Level	0.25m to 4m
Firm Tidal Flat Deposits	Between 0.3m bgl and 1.2m bgl	Up to 2.1m
Tidal Flat Deposits	Between 0.3m bgl and 1.2m bgl	8.4m to 12.2m
Glacial Till Deposits	Between 9.9m bgl and 13.1m bgl	4.98m to 11.06m
Granular Glacier Till Deposits	Between 16.76.4m bgl and 22.5m bgl	0.85m to 4.8m
Weathered Flamborough Chalk	Between 20.25m bgl and 25m bgl	1.15m to 3.75m
Flamborough Chalk	Between 23.3m bgl and 26.15m bgl	7.65m and 29.35 (proven)

21.6.26 The groundwater level monitoring data indicates that groundwater is present in all geological units beneath the Site. Perched groundwater was encountered within Made Ground, mostly within the East Site. No monitoring boreholes were installed within Made Ground in the West Site. Two boreholes were scheduled to be installed within Made Ground – W-BH26 and W-BH31. However, due to

shallow depths of Made Ground at these two locations (0.4m bgl and 0.30m bgl respectively) it was not possible to install monitoring boreholes into Made Ground. Groundwater levels within Made Ground varied between ground level and 2.5m bgl. The groundwater levels in boreholes screened within Tidal Flat Deposits within the East Site varied between 33.97m AOD to 1.63m OD. Groundwater levels within Glacial Till Deposits varied between 0.5m OD and 1.06m OD in the West Site and 1.82m OD and 2.65m OD in the East Site. Groundwater levels within monitoring wells within the Flamborough Chalk Formation varied between 0.72m OD and 3.1m OD in the East Site. All nine Chalk monitoring boreholes installed recorded artesian conditions during the monitoring period, except W-BH17 which recorded slightly lower levels (up to 1.46m bgl) on two occasions. The groundwater generally flows in a north-easterly direction towards the Humber Estuary.

21.6.27 In relation to asbestos, Chrysotile was identified in samples of Made Ground in E-BH10 (East Site Storage Tank site (Work No. 3 and 3-A)) and E-BH25 (East Site Hydrogen Production site (Work No. 5 and 5-A)) at ground level. The sample from E-BH10 was subjected to quantification testing and returned an asbestos concentration of <0.001 w/w %.

21.6.28 No exceedances of the human health Generic Assessment Criteria (“GAC”) were identified within soil samples. The results from the Hazard Quotient Assessment indicated a low risk associated with the cumulative toxicological effects from the combined Total Petroleum Hydrocarbon (“TPH”) species. No exceedances of the construction worker Acute Evaluation Criteria (“AEC”) were identified for soil samples.

21.6.29 Two rounds of surface water sampling were undertaken on 31st March 2023 and 18 May 2023 from Habrough Marsh Drain and North Beck Drain. Exceedances of the EQS were recorded for Polycyclic Aromatic Hydrocarbons (“PAHs”), metals and inorganics. Overall, it is considered that the exceedances are indicative of wider contamination within nearby surface watercourses associated with the historical and current industrial land use within Immingham. Elevated concentrations of metals were also recorded within groundwater and soil leachate samples, which may indicate natural elevated metal concentrations in the area.

21.6.30 Exceedances of the EQS Coastal criteria were recorded within soil leachate, surface water and groundwater samples for chloroform, PAHs, metals and inorganics. Most exceedances were recorded within the same order of magnitude or one order of magnitude above the EQS Coastal criteria. However, a single exceedance of cyanide was recorded at two orders of magnitude above the EQS Coastal criteria. Exceedances of ammoniacal nitrogen were recorded four orders of magnitude above the EQS Coastal criteria in Made Ground (870mg/l) and three orders of magnitude above the EQS in Tidal Flat Deposits (9.4mg/l). Exceedances of ammonium were recorded up to five orders of magnitude above the EQS in Made Ground (1,100mg/l) and three orders above the magnitude in Tidal Flat Deposits (12mg/l). The highest concentrations were recorded within E-BH15 within the East Site – Hydrogen Production area which coincides with an ammonia odour detected during the Ground Investigation within Made Ground in

E-BH14A and E-BH15. This suggests a potential localised source of ammoniacal nitrogen within Made Ground. Overall, it is considered that there may be a potential risk to the Humber Estuary associated with ammonium and ammoniacal nitrogen in groundwater. It is also noted that the ground investigation did not identify gross contamination or evidence of a major spillage. As a result, the determinands exceeding the EQS may be associated with an amalgamation of nearby industrial activity in the area.

21.6.31 Exceedances of the Drinking Water Standard ("DWS") were recorded within soil leachate and groundwater samples for hydrocarbons, PAHs, metals and inorganics in the East Site (Work No. 3, 4 and 5). An isolated and marginal exceedance of naphthalene and C12-C16 aromatics was recorded within groundwater in Made Ground and Tidal Flat Deposits respectively. Most exceedances of the DWS were recorded within the same order of magnitude or one order of magnitude above the DWS. However, concentrations of ammonium in E-BH15 (1,100mg/l) are four orders of magnitude above the DWS (0.5mg/l) within Made Ground in E-BH15. Furthermore, the concentration of nitrate in E-BH15 (1,660mg/l) is two orders of magnitude above the DWS (50mg/l). This coincides with boreholes which identified an ammonia odour during the GI. Concentrations of sodium (16,000mg/l) and chloride (3,700mg/l) were recorded in Tidal Flat Deposits groundwater up to two orders of magnitude and one order of magnitude above the DWS criteria (200mg/l and 250mg/l respectively) within the East Site. Overall, it is considered that inorganics and metals may pose a risk to groundwater quality in the East Site. No exceedances of the DWS were recorded in the West Site (Work No. 7). Therefore, there is not considered to be a risk to groundwater quality in the West Site (Work No. 7). In order to further understand any temporal trends in contaminants, additional groundwater monitoring is ongoing, but the additional data, which will be submitted into the examination at the appropriate time, are not expected to change the conclusions of the assessment presented in this chapter, which is based on a 'realistic worst case' approach.

21.6.32 The results of the ground gas monitoring indicated the Site is classified as Characteristic Situation ("CS") 5 due to concentrations of methane up to 93.9% (v/v), carbon dioxide concentrations of up to 5.9 % (v/v) and a maximum flow rate of 120l/hr. However, it should be noted that the assessment assumes the worst case ground gas conditions by using the maximum recorded gas concentrations and maximum recorded flow rates. Based on the results of the investigation and the geology of the Site, the sources of high methane concentrations are not clear. The methane concentrations were also variable at the same monitoring location throughout the monitoring rounds. It should also be noted that most standpipes were flooded which may have caused compression of gases and hence affect the concentrations recorded. Therefore, the classification of CS5 may be an overestimate of the ground gas conditions. Due to the uncertainty associated with the gas results, an additional assessment was undertaken using the Total Organic Carbon ("TOC") results in line with CL:AIRE 'A Pragmatic approach to Ground Gas Risk Assessment' (Ref 21-66) which indicates a classification of CS2. Additional ground gas monitoring is being undertaken to further confirm the gas and flow rate regime. Gas sampling and laboratory

analysis will also be undertaken to identify the potential source of the gas and validate the monitoring results obtained to date. The additional data, which will be submitted into the examination at the appropriate time, are not expected to change the conclusions of the assessment presented in this chapter, which is based on a 'realistic worst case' approach.

21.6.33 BRE Special Digest 1 testing was undertaken on 165 samples for the West Site and East Site (Storage Tank and Hydrogen Production Sites) to determine the Design Sulphate ("DS") and Aggressive Chemical Environment for Concrete ("ACEC") classifications. The findings of which are provided in **Table 21-13**.

Table 21-13. Summary of BRE Test Results

Strata	East Site (Hydrogen Production site) (Work No. 5)		East Site (Storage Tank site) (Work No. 3)		West Site (Work No. 7)	
	DS Class	ACEC Class	DS Class	ACEC Class	DS Class	ACEC Class
Made Ground	DS – 4	AC – 4	DS – 4	AC – 4	DS – 4	AC – 3s
Tidal Flat Deposits	DS – 4	AC – 3s	DS – 4	AC – 3s	DS – 4	AC – 3s
Glacial Till Deposits	DS – 3	AC – 2s	DS – 4	AC – 3s	DS – 4	AC – 3s
Granular Glacial Till Deposits	DS – 2	AC – 2	DS – 1	AC – 1	DS – 4	AC – 4
Flamborough Chalk Formation	DS – 1	AC – 1	DS – 1	AC – 1	DS – 2	AC – 2

RSK: Ground Investigation

21.6.34 A Ground Investigation was undertaken in the Pipeline Corridor area (Work No. 6) in November 2020 by RSK (Ref 21-18) and related to development proposals which comprised of a cold fridge store, two-storey modular office unit, heavy goods vehicle ("HGV") parking facilities, dock levellers and a services compound.

21.6.35 The investigation comprised seven boreholes between 5m bgl and 30.45m bgl and twelve trial pits between 2.6m bgl and 4m bgl. Six rounds of groundwater and ground gas monitoring were undertaken as part of the investigation, with chemical and geotechnical laboratory analysis also undertaken. The location of the exploratory holes is shown in **Figure 21.8 [TR030008/APP/6.3]**.

21.6.36 In summary, the strata encountered is presented in **Table 21-14**

Table 21-14: Strata encountered during the RSK Ground Investigation

Strata	Depth Encountered	Thickness Range	Description
Topsoil	Ground level	0.1m	N/A
Made Ground	Ground level	0.1m to 2.4m	The Made Ground deposits were described as “soft slightly sandy gravelly clays with occasional to frequent cobbles”’. However, it is also noted that pockets or discrete bands of granular “clayey slightly cobble or slightly sandy gravels” were also encountered. Anthropogenic material recorded in Made Ground included metal, asphalt, rebar, ash, timber, wood, concrete, brick and boulders of reinforced concrete which may be associated with former foundations or pile caps;
Tidal Flat Deposits	Between 7.9m and 8.3m	7.9m to 8.3m	The Tidal Flat Deposits were described as “soft or soft to firm grey and grey brown clay” underlain by ‘very soft dark blueish grey silty clays, generally with a frequent organic odour and some organic content’. It is noted that the Tidal Flat Deposits become very soft from approximately 9m bgl. Small bands of dry peat were encountered between 9.5m bgl and 9.7m bgl, and 10m bgl and 10.4m bgl in BH01;
Glacial Till Deposits	Between 9.4m bgl and 10.7m bgl	11.3m to 14.0m	The Glacial Till was described as “firm slightly sandy slightly gravelly slightly silty clays which became stiff with depth”. The gravel comprised of flint gravel, fine to medium chalk and occasional coarse chalk. BH01 recorded a grey and buff silty with flint and chalk gravel overlying the chalk bedrock
Flamborough Chalk	Between 22m bgl to 23.5m bgl for Grade Dm and 22.5m bgl to 25m bgl for Grade Dc. The depth to the base of the chalk was not proven.	A proven thickness between 0.5m and 1.5m for Grade Dm and a proven thickness of 5m to 7.9m for Grade Dc	Chalk is classified based on the engineering behaviour using the classification system defined in CIRIA C574 ‘Engineering in Chalk’ (Ref 21-61). Grade Dm chalk is defined as chalk where “the material will behave as a cohesive fine soil” with >35% comminuted chalk matrix and approximately <65% coarser fragments (Ref 21-61). Grade Dc chalk is described as “where clasts (intact chalk lumps) dominate”, resulting in the material behaving as “a granular, coarse soil” (Ref 21-61). There is approximately <35%

Strata	Depth Encountered	Thickness Range	Description
			communicated chalk matrix and >65% coarser fragments for Grade Dc. Grade Dm chalk was described as “a cream and white slightly sandy slightly gravelly silt” with weak gravel that had orangish brown weathering. The Grade Dc chalk was described as “white and occasionally cream silty gravel and cobbles of weak chalk, with some white and occasionally creamish grey silty matrix” with speckled gravel and cobbles with some orange, brown staining.

21.6.37 The Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation report (Ref 21-18) noted that there were generally no signs of soil contamination across the Site. Hydrocarbon odours were noted between 1.7m bgl and 2.4m bgl within Made Ground in BH01. Organic odours were observed within Made Ground and Tidal Flat Deposits, and an occasional sulphurous odour was noted within Tidal Flat Deposits.

21.6.38 Perched groundwater was encountered at the base of Made Ground deposits. Groundwater strikes were recorded between 16m bgl and 18.3m bgl in two boreholes, rising to between 12m bgl and 14.9m bgl after twenty minutes. Groundwater seepages were recorded between 1.7m bgl and 4m bgl. A summary is provided in **Table 21-15.**

Table 21-15: Summary of groundwater strikes and seepages in the 2020 Ground Investigation of the Pipeline Corridor area (Work No. 6)

Exploratory Hole	Depth	Strata
Groundwater Strikes		
BH01	16m bgl (initial strike) 12m bgl (after 20 minutes) 3.5m bgl (borehole completion)	Sand and Gravel within the Glacial Till at 16m bgl. Blowing sands were recorded at this depth.
BH02	18.3m bgl (initial strike) 14.9m bgl (after 20 minutes) 2.8m bgl (borehole completion)	Firm slightly gravelly silty clay within the Glacial Till at 18.3m bgl.
Groundwater Seepages		
WS01	3m bgl	Firm slightly gravelly silty clay within the Tidal Flat Deposits.
WS02	2m bgl	Firm slightly silty clay with the Tidal Flat Deposits.

Exploratory Hole	Depth	Strata
WS04	3.5m bgl	Firm slightly gravelly silty clay within the Tidal Flat Deposits.
WS05	2m bgl	Soft slightly gravelly slightly silty clay within the Tidal Flat Deposits. Noted as very soft and wet material at 2m bgl.
CBR02	3.4m bgl (trial pit terminated)	Very soft slightly gravelly slightly sandy silty clay within the Tidal Flat Deposits.
CBR03	1.7m bgl	Sandy angular to subangular fine to coarse gravel within Made Ground.
CBR04	3.6m bgl (trial pit terminated)	Firm silty clay within the Tidal Flat Deposits.
CBR05	3.2m bgl (trial pit terminated)	Very soft occasionally mottled silty clay within the Tidal Flat Deposits.
CBR06	3.2m bgl (trial pit terminated)	Firm and slightly friable mottled slightly gravelly silty clay within the Tidal Flat Deposits.
CBR07	3.5m bgl (trial pit terminated)	Firm grey silty clay within the Tidal Flat Deposits.
CBR08	3.8m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits.
CBR09	3.2m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits.
TP01	2.6m bgl (trial pit terminated)	Firm grey silty clay within the Tidal Flat Deposits.
TP02	4m bgl (trial pit terminated)	Soft to firm grey silty clay within the Tidal Flat Deposits

21.6.39 The depth to water was recorded as dry to 1.65m bgl within the Made Ground response zone. The monitoring wells with a response zone within the Flamborough Chalk Formation recorded depth to water between 1.53m bgl and 3.29m bgl.

21.6.40 The asbestos screening identified asbestos containing material in two out of six samples. Chrysotile loose fibres (<0.001% w/w) were detected in samples of Made Ground at 0.3m bgl and 0.5m bgl in WS05 and TP01, respectively. However, this is associated with past industrial use and the concentrations detected are not considered to present a significant risk.

21.6.41 Exceedances of DWS for nickel and selenium were recorded in two groundwater samples within two boreholes (BH01 and BH02). The exceedances were of the same order of magnitude as the DWS. There were no exceedances of nickel and selenium recorded in soil samples of Made Ground and Tidal Flat Deposits.

21.6.42 Exceedances of the GAC for coastal surface waters for nickel and zinc were recorded in two samples of groundwater within two boreholes (BH01 and BH02).

21.6.43 The results of the ground gas monitoring indicated the Pipeline Corridor Area is classified as Characteristic Situation (CS) 2 due to the concentrations of methane (7.6% and 11.4% within BH02).

21.6.44 The Waste Acceptance Criteria ("WAC") results indicated that the waste required treatment and re-testing before disposal at a hazardous landfill.

21.6.45 Running sands were encountered within Glacial Till between depths of 16m bgl and 19m bgl.

21.6.46 Ten California Bearing Ratio ("CBR") in situ tests were undertaken at the Site within Made Ground and Tidal Flat Deposits. Nine tests were completed on Made Ground samples. Of the nine tests completed, five were completed on Made Ground clay samples which had a minimum CBR value determined at or below anticipated formation level between 5.7% and 19%. Four tests were completed on Made Ground gravel samples which had a minimum CBR value determined at or below anticipated formation level between 2% and 13%. One test was completed within borehole CBR05 on Tidal Flat Deposits which had a minimum CBR value determined at or below anticipated formation level of 3.6%. The sub-grade condition at the time of construction should be confirmed and tested at the final formation level. The results indicate that sub-grade soils are frost susceptible.

21.6.47 Ten samples were tested to determine the BRE Sulphate Classification (Ref 21-18). For the purposes of the assessment, the Site was classified as brownfield ground likely to contain pyrite. The BRE test results were recorded as follows:

a. DS class DS-1 and Aggressive Classification ("AC") Class AC-1 for water soluble sulphate in Made Ground.

b. DS class DS-2 and AC Class AC-2 for total potential sulphate in Made Ground.

c. DS class DS-2 and AC Class AC-2 for water soluble sulphate in Tidal Flat Deposits.

d. DS class DS-5 and AC class AC-5 for total potential sulphate in Tidal Flat Deposits.

e. Overall, the DS class is recommended as DS-2 and the ACEC classification is recommended as AC-2.

21.6.48 The Immingham BCP Phase 2 Geo-environmental and Geotechnical Site Investigation report (Ref 21-18) concluded that there are no significant contaminant risks with regards to human health and controlled waters receptors, and also noted that the Made Ground and Tidal Flat Deposits are of a variable nature, highly compressible and of low strength.

Coal Mining

21.6.49 The Coal Authority Interactive Viewer (Ref 21-12) indicates the landside infrastructure areas within the Site are not within a Coal Mining Reporting Area or within a Development High Risk Area.

21.6.50 The information does, however, identify the Humber Estuary as designated as a Coal Mining Reporting Area and the marine infrastructure areas therefore lie within an area which may contain unrecorded coal mining related hazards.

Hydrogeology

21.6.51 A summary of the hydrogeological conditions for the Site are provided in **Table 21-16.**

Table 21-16: Aquifer Designations

Strata	Location	Designation	Definition (Ref 21-19)
Beach and Tidal Flat Deposits	Northeastern boundary of the green hydrogen production facility (Jetty Access and Pipe-Rack Corridor and Laporte Road Temporary Construction Area in the northeast) of the Site (Work No. 2 and 9)	Secondary (Undifferentiated)	The EA describe Secondary (Undifferentiated Aquifers) as *"aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. These have only a minor value".*
Tidal Flat Deposits	Entire Site, apart from the bank of the Humber Estuary.	Unproductive Aquifer	The EA describe Unproductive Aquifers as "*largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them"*.
Flamborough Chalk Formation and Burnham Chalk Formation	The Flamborough Chalk Formation is present across most of the Site, apart from a thin strip along the western boundary of the West Site. The Burnham Chalk Formation underlies the Flamborough Chalk Formation across the entire Site and underlies the western boundary of the West Site. Kings Road Work No.10 is underlain by the Burnham Chalk Formation..	Principal	The EA describe Principal Aquifers as aquifers that *"provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands".*

21.6.52 The Groundsure Report (GS-9009838) (Ref 21-16) indicates that the North Lincolnshire Chalk Unit (a WFD groundwater body) is located on the Site. The overall rating, chemical rating and quantitative rating (dated to 2019) are described as 'poor'.

21.6.53 There are no Drinking Water Protected Areas (Surface Water) or Drinking Water Safeguard Zones (Groundwater) located within the Site.

21.6.54 The groundwater vulnerability map on Defra's MAGIC Maps (Ref 21-13) and in the Groundsure Report (GS-9009838) (Ref 21-16) indicates that the West Site (Work No. 7), East Site (Work No. 3, 3-A, 4, 5 and 5-A), most of the Pipeline Corridor (Work No. 6), Queens Road Temporary Construction Area (Work No. 8) and the southern extent of the Pipe-Rack and Jetty Access Road (Work No.2) and Kings Road (Work No. 10) have a Low groundwater vulnerability. The EA (Ref 21-20) describe a Low groundwater vulnerability as "areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of low permeability superficial deposits". The Low classification is derived from the combination of a productive bedrock aquifer and an unproductive superficial aquifer.

21.6.55 The Laporte Road Temporary Construction Area (Work No. 9), and the northeast area of the East Site – Hydrogen Production site (Work No. 5) and Pipe-Rack and Jetty Access Road (Work No. 2) are designated as Medium – High groundwater vulnerability on Defra's MAGIC Maps (Ref 21-13) and as High vulnerability in the Groundsure Report (GS-9009838) (Ref 21-16). The EA (Ref 21-20) describes Medium groundwater vulnerability as "areas that offer some groundwater protection. Intermediate between high and low vulnerability" and High groundwater vulnerability as "areas able to easily transmit pollution to groundwater. They are characterised by high leaching soils and the absence of low permeability superficial deposits". The high vulnerability is derived from the combination of a productive superficial (Secondary Undifferentiated Aquifer within the Beach and Tidal Flat Deposits) and a productive bedrock aquifer (Principal Aquifer within the Flamborough Chalk Formation). The high vulnerability is also related to the combination of a productive bedrock aquifer (Principal Aquifer within the Flamborough Chalk Formation) and an unproductive superficial aquifer (Tidal Flat Deposits) in the remaining areas of the Laporte Road Temporary Construction Area (Work No. 9) which are underlain by Tidal Flat Deposits and in turn Devensian Till deposits.

21.6.56 SPZs are located on the Site, as shown in **Figure 21.6 [TR030008/APP/6.3]**. An SPZ 1 (Inner Catchment) is located in the southern half of the Site within the Pipeline Corridor (Work No. 6), Queens Road Temporary Construction Area (Work No. 8) and West Site (Work No. 7), near Queens Road. The EA (Ref 21-21) describes an SPZ 1 as a "50 day travel time of pollutant to source with a 50m default minimum radius". An SPZ 2 (Outer Catchment) radiates out from the SPZ 1 towards the south, and encompasses the southern half of the Site, including the West Site (Work No. 7), and further north within the proposed Pipeline Corridor (Work No. 6). The EA (Ref 21-21) describe an SPZ 2 as a "400 day travel time of pollutant to source. This has a 250 or 500m minimum radius around the source depending on the amount of water taken". An SPZ 3 (Total Catchment) is located around the SPZ 2, and encompasses the remainder of the Site, including the Pipe-Rack and Jetty Access Road (Work No.2) East Site (Work No. 3, 3-A, 4, 5 and 5-A) and Laporte Road Temporary Construction Area (Work No. 9). The EA (Ref 21-21) describe an SPZ 3 as "the area around a supply source within which all the groundwater ends up at the abstraction point.

This is the point from where the water is taken. This could extend some distance from the source point". The SPZ is likely associated with an abstraction within the Flamborough Chalk Formation off-site due to the designation as a Principal AquiferThe Chalk is overlain and confined by a considerable thickness of superficial strata which are themselves not productive aquifers.

21.6.57 An SPZ 2c (Outer Catchment within a Confined Aquifer) is also located on the Site, within the northern corner of the West Site (Work No. 7). It is noted in the Groundsure Report (GS-9009838) (Ref 21-16) that a "confined aquifer would normally be protected from contamination by overlying geology and is only considered a sensitive resource if deep excavation/drilling is taking place". The SPZ 2c is likely to be associated with the Flamborough Chalk Formation.

21.6.58 There are no groundwater abstractions located within the Site Boundary. The closest groundwater abstraction is located 37m northwest from the West Site (Work No. 7) associated with a historical raw water supply abstraction. This groundwater abstraction is associated with the SPZ 1 within the Site Boundary.

21.6.59 In addition to the above abstraction, there are a further eight groundwater abstractions within 1km of the Site.

21.6.60 Of the nine groundwater abstractions, three are considered to be active abstractions and six are considered to be historical abstractions.

Surface Waters

21.6.61 The EA Catchment Data Explorer (Ref 21-14) and the Groundsure Report (GS-9009838) (Ref 21-16) indicate the entire Site is located within the catchment for the North Beck Drain water body. Its ecological classification (dated to 2019) is defined as 'moderate'. Its chemical classification (dated to 2019) is defined as 'fail' for priority hazardous substances Mercury and its Compounds and Polybrominated Diphenyl Ethers ("PDBE"). The water body is also described as 'heavily modified'. The North Beck Drain is located immediately adjacent to the eastern Site Boundary in the north of the Site, near to the Laporte Road Temporary Construction Area (Work No. 9). The Habrough Marsh Drain is part of the North Beck Drain catchment and is located to the west of the Site.

21.6.62 The marine area within the Site is located within the Humber Lower Transitional Water Body. The ecological classification (dated to 2019) is defined as 'moderate' and the chemical classification (dated to 2019) is defined as 'fail' for priority hazardous substances Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Mercury and its compounds, Perfluorooctane Sulphonate ("PFOS"), PDBE and Tributyltin Compounds. The 'fail' classification is also associated with priority substances Cypermethrin (Priority hazardous) and Dichlorvos (Priority). The Humber Lower Transitional Water Body is also described as heavily modified.

21.6.63 There are approximately 44 Ordnance Survey ("OS") Water Network Lines located on the Site, comprising unidentified inland rivers on the ground surface and underground that are not influenced by normal tidal action. The OS Water Network Lines map provided in the Groundsure Report (GS-9009838) (Ref 21-16) is not clear. However, it indicates that water lines are located across the Site. There are a further 28 OS Water Network Lines within 50m of the Site Boundary,

and 49 OS Water Network Lines between 50m and 500m from the Site Boundary.

21.6.64 There are no licensed surface water abstractions inside, or within 1km of, the Site boundary.

Historical Development

21.6.65 A summary of the historical development inside, and within 500m of, the Site Boundary is provided in **Table 21-17**.

21.6.66 Historical maps from the Groundsure Report (GS-9009838) (Ref 21-16) were referenced to produce a summary of historical development.

Table 21-17: Summary of historical development within the Site and the 500m study area

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
1886 – 1888 (1:2,500 and 1:10,560)	• Agricultural fields in all areas of the Site. • 'North Beck Drain' is denoted within the Laporte Road Temporary Construction Area (Work No. 9). • A surface water feature and a forested area identified as 'Long Strip' (a forested area) are shown in the Pipeline Corridor and Pipe-Rack and Jetty Access Road (Work No. 2 and 6). • 'Beacons' are denoted in the Laporte Road Temporary Construction Area (Work No. 9).	• Agricultural fields in all areas of the Site. • 'North Beck Drain' is denoted approximately 345m southeast from the West Site (Work No. 9). • 'Springs' are denoted at 'Habrough Marsh' approximately 185m west from the Pipeline route, approximately 360m south and 400m southeast from the West Site (Work No. 7). • A water feature flowing northeast is shown immediately west from the Pipeline Corridor and East Site (Work No. 3, 3-a, 4, 5 and 5-A). • A 'Sluice' is denoted approximately 225m north from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • A 'Pump' is shown approximately 105m east from the Laporte Road Temporary Construction Area (Work No. 9), associated with the 'Ship Inn' and 'Stallingborough Light' and approximately 320m east from the Site associated with the 'Coastguard Station'.
1905 – 1906 (1:10,560)	• Two 'Springs' are shown in West Site (Work No. 7) and two 'Springs' are shown within the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8) .	• Multiple 'Springs' are denoted within a 1km radius from the Site. • A 'Well' is denoted at 'Habrough Marsh' west of the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8).

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		• The pumps at the 'Ship Inn' and 'Coastguard Station' to the east of the Laporte Road Temporary Construction Area (Work No. 9) are no longer shown.
1907 (1:2,500)	• Water features, assumed to be drains, are shown through the Pipeline Corridor (Work No. 6).	• A small pond or lake is denoted adjacent to the Pipeline Corridor (Work No. 6) .
1910 (1:10,560)	• No significant changes.	• Further 'Springs' are denoted within 1km west from the Site Boundary.
1930 – 1931 (1:10,560)	• Residential housing is shown adjacent to 'Queens Road' in the West Site (Work No. 7). • 'L.N.E.R. Grimsby District Electric Light Railway' is shown through the centre of the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8) orientated northeast to southwest and northwest to southeast. Embankments are denoted either side of the railway. • A 'Shelter' is denoted in the centre of the Pipeline Corridor (Work No. 6).	• Railway sidings are denoted approximately 80m north from the West Site (Work No. 7). • A 'Signal Box', 'Engine Shed' and 'Store' are shown between approximately 130m and 560m northwest from the West Site (Work No. 7). • A 'Sewage Works' is denoted approximately 60m east from the Pipeline Corridor and East Site Ammonia Storage site (Work No. 3, 3-A and 6). • An 'Allotment Garden' is shown adjacent to the northern boundary of the West Site (Work No. 7). • A 'Methodist Church' and a 'Club' are denoted approximately 500m west from the West Site (Work No. 7). • The 'Ship Inn', 'Stallingborough Light' and the 'Coastguard Station' are no longer denoted near the Laporte Road Temporary Construction Area (Work No. 9), however, the buildings are still shown.
1932 (1:2,500)	• The 'North Beck Drain' is diverted outside of the Laporte Road Temporary Construction Area Site Boundary (Work No. 9). • A small building is shown near the southern boundary of the Pipeline Corridor (Work No. 6).	• A 'Well' is shown near the buildings formerly identified as a 'Coastguard Station' near the Laporte Road Temporary Construction Area (Work No. 9).
1938 (1:10,560)	• No significant changes.	• No significant changes.
1946 – 1947 (1:10,560)	• A further small building is denoted near the southern	• No significant changes.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
	boundary of the Pipeline Corridor (Work No. 6).	
1947 – 1948 (1:10,560)	• No significant changes.	• No significant changes.
1947 – 1951 (1:10,560)	• No significant changes.	• Buildings are denoted approximately 500m west from the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8) near the railway sidings.
1951 – 1956 (1:10,560)	• A 'Gypsum Disposal Bed' is denoted partially on the West Site Boundary (Work No. 7) and extends further southeast off-Site. • The 'L.N.E.R. Grimsby District Electric Light Railway' is no longer shown in the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8).	• Buildings and railway lines associated with a 'Chemical Factory' are denoted approximately 350m southeast from the Laporte Road Temporary Construction Area (Work No. 9).
1964 (1:2,500)	• 'Drains' are denoted in the West Site, Queens Road Temporary Construction Area and the Pipeline Corridor (Work No. 6, 7 and 8). • Further small buildings are denoted on the boundary of the West Site (Work No. 7). • Electricity lines are denoted through the East Site (Work No. 3, 3-a, 4, 5 and 5-A).	• Buildings are denoted 30m west from the West Site (Work No. 7). • 'Water' is denoted immediately south from the West Site (Work No. 7). • 'Pipelines' are denoted immediately adjacent to the west of the Queens Road Temporary Construction Area (Work No. 8) and approximately 400m west from the Site. • One of the railway lines associated with 'L.N.E.R. Grimsby Electric Light Railway' is denoted as 'Disused' to the northwest of the East Site (Work No. 3, 3-A, 4, 5 and 5-A). • Several circular structures are denoted approximately 500m west from the East Site (Work No. 3, 3-A, 4, 5 and 5-A). • A 'Works' and 'Tanks' are shown adjacent to the 'Sewage Works' near the Pipeline Corridor (Work No. 6). • An 'Electric Sub Station' is shown approximately 10m southeast from the

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		Pipe-Rack and Jetty Access Road (Work No. 2). • A 'Jetty' is denoted adjacent to the 'Sluice' on the Humber Estuary approximately 235m north from the East Site area (Work No. 3, 3-a, 4, 5 and 5-A). • 'Drains' are denoted to the east of the Laporte Road Temporary Construction Area (Work No. 9). • A 'Pond' is denoted approximately 80m east from the northeast corner of the Site Boundary. • The 'Chemical Factory' is now denoted as a 'Works'. • Multiple buildings, a 'Chimney' and circular structures associated with a 'Works' are denoted adjacent to 'Green Lane' approximately 270m east from the Laporte Road Temporary Construction Area (Work No. 9). • A 'Jetty' is denoted near the 'Works' approximately 428m east from the Laporte Road Temporary Construction Area (Work No. 9).
1965 – 1968 (1:2,500 and 1:10,560)	• The 'Spring' in the west of the Site is no longer shown and further 'Drains' are denoted.	• Several buildings are denoted adjacent to the boundary of the West Site near 'Kings Road' (Work No. 7). • The 'Methodist Church' and 'Club' are no longer denoted, and a 'Hospital' and 'Warehouse' are shown in a similar location. • A 'Sports Ground' and a 'Pavilion' are denoted approximately 450m northwest from the West Site (Work No. 7). • Buildings associated with 'Works' are denoted approximately 500m west from the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8). • The 'Gypsum Disposal Beds' to the east of the West Site (Work No. 7) are no longer shown.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
1969 – 1972 (1:2,500)	• Electricity pylons are denoted through the West Site (Work No. 7) and extends further offsite. • 'Pipelines' are shown on the northwest Site Boundary in the Pipe-Rack and Jetty Access Road (Work No. 2) which extend off-site.	• An 'Electric Sub Station' is denoted approximately 40m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • An 'Oil Storage Depot' is denoted approximately 200m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A). • Multiple 'Tanks' are denoted within 500m west from the East Site (Work No. 3, 3-a, 4, 5 and 5-A) associated with the 'Oil Storage Depot', an unspecified 'Works' and a 'Chemical Works'. • 'Electric Sub Stations' are denoted adjacent to the Site Boundary and approximately 15m west from the West Site (Work No. 7). • A 'Transforming Station' and a 'Pump House' are shown approximately 25m west and 200m west from the Site (West Site area) respectively (Work No. 7). • The 'Engine Shed' associated with the railway sidings located to the north of the West Site area (Work No. 7) is no longer shown, and a 'Wagon Repair Shed', 'Tanks' and a smaller 'Engine Shed' are shown in a similar location. • A 'Pipeline' is shown approximately 320m north from the West Site area (Work No. 6) near the railway sidings. • A 'Warehouse' and 'Chemical Works' are denoted approximately 85m and 80m east from the East Site (Work No. 3, 3-a, 4, 5 and 5-A) respectively on 'Laporte Road'. • An 'Oil Storage Depot' with multiple 'Tanks' is denoted approximately 35m north from the East Site (Work No. 3, 3-a, 4, 5 and 5-A), near to the Humber Estuary. • 'Pipelines' and 'Jetty (Oil Terminal)' are denoted approximately 365m northwest from the East Site (Work No. 3, 3-A, 4, 5 and 5-A) into the Humber Estuary. • Another 'Chemical Works' with multiple 'Tanks' is denoted approximately 100m east from the northeast corner of the Site.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
1972 – 1976 (1:10,000)	• No significant changes.	• No significant changes.
1976 – 1979 (1:2,500)	• No significant changes.	• Further 'Tanks' and 'Chimneys' are denoted to the west of the East Site associated with the 'Oil Storage Depot' and 'Chemical Works'. • Two circular structures are denoted at the 'Sewage Works' to the east of the Pipeline Corridor and East Site Ammonia Storage site (Work No. 3, 3-A and 6).. • The 'Works' near the 'Sewage Works' to the east of the Pipeline Corridor (Work No. 6) are no longer denoted. • A building associated with 'GVC' is shown approximately 270m east from the Laporte Road Temporary Construction Area (Work No. 9). • Further buildings and structures are shown associated with the 'Chemical Works' to the east of the Laporte Road Temporary Construction Area (Work No. 9).
1980 – 1985 (1:2,500 and 1:10,000)	• No significant changes.	• A 'GVC' and 'Pumping Station' are located adjacent to the Site Boundary in the West Site area (Work No. 7). • A 'Pipeline' is shown approximately 70m north from the West Site area (Work No. 7). • Another 'GVC' is denoted approximately 230m southeast from the Laporte Road Temporary Construction Area (Work No. 9).
1985 – 1987 (1:2,500)	• The 'Springs' in the Pipeline Corridor (Work No. 6) and Queens Road Temporary Construction Area (Work No. 8) are no longer shown.	• The 'Transforming Station' to the west of the West Site (Work No. 7) is now denoted as an 'Electric Sub Station' and the 'GVC' is denoted as a 'Gas Valve Compound'. • The 'Water' denoted immediately south of the West Site (Work No. 7) is no longer shown. • The circular structures at the 'Sewage Works' to the east of the Pipeline Corridor (Work No. 6) are identified as 'Filter Beds'.

Date and Scale	Significant Features On-Site	Significant Features Off-Site (within 500m radius)
		• A 'Warehouse' is denoted approximately 500m southeast from the West Site (Work No. 7). • A 'Pipeline' is denoted approximately 410m southeast from the Pipeline Corridor and East Site (Work No. 3, 3-A, 4, 5 and 5-A), near the 'GVC' and 'North Beck Drain'.
1988 (1:10,000)	• No significant changes.	• The railway lines associated with the 'Works' adjacent to the Laporte Road Temporary Construction Area (Work No. 9) are now identified as a 'Dismantled Railway'.
2001 (1:10,000)	• No significant changes.	• 'Works' are denoted approximately 50m northwest from the West Site area (Work No. 7). • Small ponds are denoted within the 'Oil Storage Depot' to the west of the East Site (Work No. 3, 3-A, 4, 5 and 5-A). • The 'GVC' and 'pipeline' to the southeast of the Laporte Road Temporary Construction Area (Work No. 9) are no longer denoted. • Further 'Works' are denoted adjacent to the eastern Site Boundary in the Laporte Road Temporary Construction Area (Work No. 9).
2010 (1:10,000)	• No significant changes.	• A 'Recycling Centre' is denoted adjacent to the West Site boundary (Work No. 7). • A pond is shown approximately 50m southeast from the West Site (Work No. 7).
2022 (1:10,000)	• No significant changes.	• The 'Recycling Centre' located to the West Site (Work No. 7) is no longer shown. • Further ponds are shown to the southeast of the West Site (Work No. 7). • Circular structures associated with the 'Oil Storage Depot' near the Humber Estuary are no longer shown and a 'pipeline' through the Port to the west of the Site is no longer shown.

Regulated Processes and Pollution Incidents

21.6.67 The following regulated processes and pollution incidents are recorded on the Site and within 500m of the Site Boundary:

a. Recent industrial land uses on the Site include water pumping stations, energy production (landfill gas and a power station), vehicle services (hire, rental, services and repairs), industrial engineers, pylons, a chimney, tools and machine shops, recycling, reclamation and disposal and a gas governor.

b. Within 50m from the Site Boundary, there are electrical features (pylons, electric sub stations), telecommunications, engineering services, distribution and haulage services, hoppers and silos, gas valve compounds, industrial products, fuel distributors and supplies, moorings and unloading facilities, recycling centres plasterboard manufacturer and a gas governor.

c. Three current Control of Major Accident Hazards ("COMAH") Upper Tier sites associated with Exolum Immingham Limited and Associated British Ports ("ABP") are recorded within the Site Boundary. An historical Notification of Installations Handling Hazardous Substances ("NIHHS") site is located within the Site Boundary associated with Arkema Coatings Resin Limited.

d. A current COMAH site is located approximately 23m southeast from the Site Boundary relating to Tronox Pigment UK Limited. A current lower tier COMAH site is operated by Associated British Ports approximately 432m northwest from the Site.

e. There are three hazardous substance storage/usage sites located at the following locations: approximately 68m south currently associated with Arkema Coatings Ltd; 118m northeast operated by Associated Petroleum Terminals and 365m northwest operated by Origin UK Ltd.

f. Permits for Integrated Pollution Control records are held approximately 57m northeast for petroleum processes operated by Associated Petroleum Terminals. Permits are held by the following operators approximately 400m south from the Site: Innogy Cogeneration Ltd (for combustion processes); Millennium Inorganic Chemicals Ltd (for acid processes) (revoked) and Npower Cogen Energy Ltd (for combustion processes) (revoked). Millennium Inorganic Chemicals Ltd held permits for halogen processes approximately 486m southeast from the Site.

g. UK Power Reserve Limited hold a permit for licenced industrial activity (fuel combustion) within the Site Boundary. There are multiple records for licenced industrial activities within 500m from the Site including Arkema Coatings Resins Limited approximately 80m south; UK Power Reserve Limited approximately 80m southwest; Immingham Power Limited approximately 81m southeast; Associated Petroleum Terminals Ltd approximately 110m north; Associated Petroleum Terminals Ltd approximately 145m northeast; Knauf UK approximately 300m northwest and 370m northwest; North Beck Energy Limited approximately 320m east; Integrated Waste Management approximately 320m southeast; PX Ltd and Npower Cogen Ltd approximately 350m southeast and 380m southeast; and Millennium Inorganic Chemicals,

Tronox Pigment UK Ltd and Cristal Pigment UK Ltd approximately 486m southeast.

h. Knauf UK (Gypsum) hold a permit for other mineral processes within 50m of Work No.10 and approximately 180m northwest from the rest of the Site.

i. There are no records for radioactive substance authorisations within the Site Boundary. FCC Recycling (UK) Limited have an approved permit for keeping and use of radioactive materials and disposal of radioactive waste. Millennium Inorganic Chemicals Ltd held a permit for radioactive substance authorisations for the disposal pf radioactive waste approximately 480m south. The status is recorded as revoked/cancelled.

j. Anglian Water Service Limited and Immingham Water Recycling Centre hold permits for licenced discharges to controlled waters for sewage discharges into the River Humber located within the Site Boundary.

k. Two permits for licenced discharge into controlled waters were held on the Site Boundary for sewage discharges into an unknown tributary of the North Beck Drain, although these were revoked in May 1995 and December 2000. Further permits are held between 60m northwest and 260m northwest associated with sewage discharges, trade effluent and miscellaneous surface water discharges.

l. Pollution inventory substance records indicate that Non-Methane Volatile Organic Compounds (“NMVOCs”), methane, nitrogen oxides are reported annually as part of the Queens Road Power Station within the Site Boundary. Records are provided for reporting thresholds of other substances as a result of the Queens Road landfill which encroaches on the boundary of the Site. In addition records are provided for methane, nitrogen oxides and carbon dioxide relating to Knauf GmBH, a plasterboard manufacturer which is located approximately 50m from Kings Road Work No.10

m. Pollution inventory waste transfer records are held within the Site Boundary associated with the Queen’s Road Power Station and Queens Road landfill which encroaches on the Site Boundary. The descriptions relate to septic tank sludge, mixed municipal waste, street cleaning residues, landfill leachate.

n. List 1 Dangerous Substance, taken from the Groundsure report GS-9009838, records include Riverside Electroplaters who operate a discharge of cadmium into the River Humber located within the Site Boundary. List 1 Dangerous Substances are held at Immingham Landfill Site and the Tankclean Tankwash site approximately 124m southeast. Immingham Oil Terminal and Millenium Inorganic Chemicals (now Tronox) have authorisation for the discharge of mercury (other) and cadmium approximately 375m northwest and 486m southeast respectively. Immingham Stw discharged List 1 Dangerous Substances approximately 124m southeast, however, this is no longer active.

o. List 2 Dangerous Substance, taken from the Groundsure report GS-9009838, records within 50m of the Site Boundary include historical releases of pH by Jefco Services Ltd approximately 9m northeast and unknown substances by Immingham Stw approximately 50m southeast. Associated Petroleum Terminals discharge iron and zinc into the River Humber approximately 59m

northwest. Further List 2 Dangerous Substance discharge records are held between approximately 124m southeast and 375m northwest.

p. A pollution incident was recorded on 21 February 2003 associated with adhesives approximately 15m northwest from the Site. The land and air impact were recorded as Category 4 (No Impact) and the water impact was recorded as Category 3 (Minor).

q. A pollution incident occurred on 20 August 2001 approximately 78m northwest associated with oils and fuels. The water impact was recorded as Category 3 (Minor) and the air and land impact was recorded as Category 4 (No Impact). Another pollution incident occurred on 27 June 2003 approximately 79m southeast associated with organic chemicals / products. The air impact was recorded as Category 3 (Minor) and the water and land impact was recorded as Category 4 (No Impact). A pollution incident occurred on 25 July 2002 approximately 339m southeast associated with specific waste materials. The water, land and air impact were recorded as Category 4 (No Impact).

r. Pollution inventory substance records are held approximately 80m southwest (UK Power Reserve Limited), 81m southeast (Integrated Waste Management Limited), 347m southeast (Tronox Pigment UK Limited) and 367m northwest (Knauf UK).

s. Pollution inventory waste transfer records are held approximately 80m southwest (UK Power Reserve Limited), 81m southeast (Integrated Waste Management Limited), 347m southeast (Tronox Pigment UK Limited) and 367m northwest (Knauf UK).

Landfills

21.6.68 An active landfill is partially located on the eastern side of the Site Boundary, within the West Site area (Work No. 7). The landfill is operated by Integrated Waste Management Ltd with a capacity of >25,000 tonnes excluding inert waste. The status is recorded as effective.

21.6.69 The border of a historical gypsum disposal bed waste site encroaches on the south-eastern side of the Site Boundary, within the West Site (Work No. 7) and Pipeline Corridor (Work No. 6) of the site. A further historical waste site (landfill works) is located within the Site Boundary in the West Site. A waste transfer station is located 458m east from the Site.

21.6.70 Two historical landfill sites are recorded on the south eastern boundary of the West Site and Pipeline Corridor (Work No. 6 and 7) and 369m southeast from the West Site within the Site, associated with refuse tips. A further historical landfill is located approximately 92m northwest from the proposed pipeline route within the Site associated with inert and industrial waste. The last input date was recorded as 31 December 1990.

21.6.71 There are five licenced waste sites located between 41m and 304m from the Site Boundary:

a. Immingham Household Waste Recycling Centre encroaches within the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8), and is associated with household, commercial and industrial waste with a capacity for 25,000 tonnes. The status is recorded as 'modified'.

b. Immingham Landfill Site is located 41m southeast from the West Site associated with household, commercial and industrial waste with a capacity of 25,000 tonnes. The permit status is recorded as To Pollution Prevention Control ("PPC").

c. Sandstop Recycling is located approximately 98m northwest from the Queens Road Temporary Construction Area (Work No. 8) and is associated with inert and excavation waste and treatment with a capacity of 25,000 tonnes. The status is recorded as 'surrendered' dated March 2017.

d. Immingham Oil Terminal is located approximately 108m north from the East Site Hydrogen Production site (Work No. 5 and 5-A) and is associated with household, commercial and industrial waste with a capacity of 75,000 tonnes. The status is recorded as 'modified'.

e. Immingham Landfill Site is located approximately 213m southeast from the West Site (Work No. 7) and is associated with a co-disposal landfill site and household, commercial and industrial waste. The capacity of the co-disposal site is recorded as 75,000 tonnes and the capacity of the household, commercial and industrial waste site is recorded as 25,000 tonnes. The permit status of the site is recorded as Integrated Pollution Prevention and Control ("IPPC").

21.6.72 Immingham Dock Special Waste Transfer Station is located approximately 304m north from the East Site with a 25,000-tonne capacity. The status is recorded as 'surrendered' dated March 2000.

21.6.73 There are five records for waste exemptions between 50m and 250m from the Site, and a further twelve between 250m and 500m from the Site Boundary.

Environmental and Geotechnical Risk Assessments

21.6.74 To inform the design-development of the Project and establish existing conditions at the Site, an Environmental Risk Assessment ("ERA") was undertaken in 2022 and reported in the Immingham Green Energy Terminal Phase 1 Geo-environmental and Geotechnical Desk Study (Ref 21-63), as well as a Geotechnical Risk Assessment and an Initial Ground Hazards Assessment (reported in the Immingham NH3 Import Terminal Development Appraisal Report (Ref 21-17)).

21.6.75 The ERA has been updated following the completion of a human health and controlled waters screening exercise, reported in **Appendix 21.B Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4].**

21.6.76 The updated ERA has identified the following risks:

a. The risk to future site users is considered *Low* for contaminant linkages associated with direct contact, ingestion and inhalation from contaminants within soil, soil leachate and groundwater. The risk to future site users is

considered *Moderate / Low* for contaminant linkages associated with the inhalation of ground gas.

b. The risk to construction workers is considered *Moderate/Low* to *Moderate* for all contaminant linkages.

c. The risk to adjacent site users is considered *Low* for all contaminant linkages.

d. The risk to buildings and infrastructure is considered *Moderate/Low* to *Moderate* for all contaminant linkages.

e. The risk to shallow groundwater (within Secondary Undifferentiated Aquifer) is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate for on-site sources and *Moderate/Low* for off-site sources. The risk to shallow groundwater associated with potential contaminants within the soil is considered *Very Low*.

f. The risk to deep groundwater (Principal Aquifer of the Flamborough Chalk Formation) is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate for on-site sources and *Moderate / Low* for off-site sources. The risk to deep groundwater associated with potential contaminants within the soil is considered *Low*.

g. The risk to surface water is considered *Moderate* for contaminant linkages associated with contaminants in groundwater and soil leachate. The risk to surface associated with potential contaminants within the soil is considered *Low*.

h. The risk to flora and fauna is considered *Very Low* to *Low*.

21.6.77 An updated Geotechnical Risk Assessment has been undertaken and is presented in **Appendix 21.B Phase II Ground Investigation Interpretative Report [TR030008/APP/6.4].**

21.6.78 The updated Geotechnical Risk Assessment identified the following medium to high risks:

a. A *medium* risk associated with the presence of Made Ground.

b. A *high risk* associated with aggressive ground and groundwater conditions that may degrade buried concrete and steel.

c. A *medium risk* associated with existing underground and overhead services.

Future Baseline

21.6.79 The future baseline conditions for ground conditions and land quality are anticipated to remain unchanged from those as described in **Section 21.6** in the absence of the Project.

21.7 Development Design and Impact Avoidance

21.7.1 Details of the embedded and standard mitigation measures in relation to the geological and hydrogeological environment for the construction and operational phases of the Project are provided in the following sections, with a summary of these measures presented in **Table 21-19**.

Embedded Mitigation Measures

21.7.2 The Project has been designed, as far as possible, to avoid and minimise impacts, effects and risks to ground conditions and land quality receptors through the process of design-development, and by embedding mitigation measures into the design.

21.7.3 Specific measures include building and foundation design, and institutional controls for the prevention of contamination associated with operations at the Site through an Environmental Permit.

21.7.4 Measures relating to remediation to manage any significant and unacceptable contamination risks identified as part of this assessment are presented in the **Outline Remediation Strategy** for the landside elements of the Site forming part of **Appendix 21.C [TR030008/APP/6.4].** Detailed Ground Investigation information was available for majority of the landside extent of the Site to inform the preparation of the **Outline Remediation Strategy** but no detailed data were available for the Pipeline Corridor (Work No. 6) or the narrow corridor through the Long Strip woodland for the Pipe Rack and Jetty Access Road (Work No. 2) was unavailable for inclusion. Ground Investigation data for those more limited areas will be available shortly. The absence of data from these more limited areas would not affect the conclusions of the land quality assessment presented in this chapter as it is prepared on a 'realistic worst case', which assumes unknown contamination could be present in these areas.

21.7.5 The content of **Outline Remediation Strategy** forming **Appendix 21.C [TR030008/APP/6.4]**, will form the basis of a Final Remediation Strategy, in which the potential for re-use of surplus materials on Site, and the potential for disposal or onward management will be considered to ensure appropriate re-use of materials off Site. If it is identified that surplus materials can be reused on Site, the Final Remediation Strategy (or Strategies) will define any treatment measures required and a risk-based compliance criteria for soils to be screened against prior to reuse. If soil materials are considered to be surplus, the soil materials will be classified under the Waste Framework Directive ("Waste FD") (2009/98/EC) (Ref 21-64) as hazardous (17-05-03) or non-hazardous (17-05-04) soils using a propriety assessment tool (e.g., "HazWasteOnlineTM". WAC testing will be required if waste is deemed as hazardous before disposal in a landfill. The Final Remediation Strategy (or Strategies) will be prepared by the contractor in accordance with the **Outline Remediation Strategy** forming **Appendix 21.C [TR030008/APP/6.4]**, prior to the commencement of construction in the relevant part of the Site and secured by Requirement in the draft DCO.

21.7.6 Given that asbestos was encountered in the Ground Investigation and that asbestos presence has been confirmed and quantified through chemical screening, an Asbestos Management Plan ("AMP") has been prepared to manage this risk during the construction phase. The AMP has been appended to the Outline CEMP **[TR030008/APP/6.5]** as Appendix E.

21.7.7 To ensure suitable re-use of materials such as crushed concrete and soils a Materials Management Plan ("MMP") will be produced for the Project and incorporated into the Final CEMP, as noted in the Outline CEMP **[TR030008/APP/6.5]**. This will accord with the provisions of the CL:AIRE

Definition of Waste Code of Practice ("DoW CoP") and demonstrate that material has been deposited in an appropriate manner and will not pose an unacceptable risk to human health or the environment. A completed MMP will be submitted to a Qualified Person for approval, a declaration will be issued under the CL:AIRE DoW CoP and approved by CL:AIRE and will be submitted to the Environment Agency for its records, before any works to which the MMP relates commence.

21.7.8 Following the Ground Investigation and geotechnical assessments, the construction methodology of the Project will be assessed prior to commencement of the Project (as noted in the **Outline CEMP [TR030008/APP/6.5]**) to consider and reduce if necessary the potential risk associated with the development of preferential pathways if piling, other deep foundations or ground improvements are required. Preferential pathways may be created between the Made Ground, superficial Secondary Undifferentiated Aquifers and the Principal Aquifer in the bedrock as a result of the construction of the Project. For example, if piled foundations are required and contamination is identified on the Site, it is anticipated that a piling risk assessment will be undertaken which will comply with industry best practice such as the EA Guidance "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention" (Ref 21-23) and "Piling in Layered Ground: risks to groundwater and archaeology – Since Report SC0200074/SR" (Ref 21-24). Piling method statements will detail measures to protect the aquifer if there is potential to cause pollution.

21.7.9 Impermeable surfacing and bunding may be incorporated into the detailed design of the Project, where appropriate, to mitigate potential effects associated with the accidental spillage of polluting materials.

21.7.10 To mitigate the potential risk to development infrastructure, the Project's operational infrastructure and selection of materials will be designed in a manner that accounts for any potential aggressive ground conditions identified through the Ground Investigation. This includes incorporating appropriate ground gas mitigation measures within buildings, in accordance with BS8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (Ref 21-62).

Standard Mitigation Measures

21.7.11 Standard mitigation measures have been identified for implementation by the contractor during the construction, operation and decommissioning phases of the Project. Throughout all Project phases, the contractor will be required to comply with all relevant Health and Safety legislation when undertaking works, activities and operations within the Site.

Construction Phase

21.7.12 The contractor will be required to prepare a final CEMP prior to construction.

21.7.13 An **Outline CEMP [TR030008/APP/6.5]** has been prepared as part of the DCO application. This document describes the measures identified to limit the dispersal and accidental release of soil derived dusts, uncontrolled run-off and

accidental releases of potential contaminants. Example measures are summarised as follows.

21.7.14 Best practice guidance and mitigation measures will be adhered to during construction, in order to prevent or minimise spillage risks and impacts during the construction phase. The measures also address accidental spillages associated with building construction, foundations, concrete usage and the management of concrete batching.

21.7.15 To minimise the potential for run-off from material stockpiles to surface water bodies, any stockpiled material stored on the Site will be stored at a suitable distance from watercourses. If such material stockpiles are not used within three months, temporary covers will be implemented. Erosion protection matting may also be used. Collectively, these measures will minimise the potential for sediment mobilisation via wind and water flows.

21.7.16 Topsoil removal or stockpiling isn't proposed in the Laporte Road Temporary Construction Area as soils will need to be levelled and compacted, prior to use as a laydown area. This area will be subject to light grading, with a breathable heavy duty ground mat protection applied following these works to reduce potential compaction from materials laydown and associated activities.

21.7.17 To further prevent the potential for surface run-off and mobilisation of potential contaminants, any washing of vehicles and equipment will be undertaken in controlled areas only. Such locations will be defined in the Final CEMP, which will be submitted to, and approved in writing by, the local planning authority. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discuss further standard mitigation measures to be implemented in order to prevent and minimise potential pollution to surface watercourses, including the use of an oil spill contingency plan and spill kits on site.

21.7.18 Construction workers on Site will adhere to the CEMP and site-specific health and safety risk assessments, legislation and regulations as set out in the Construction Phase Plan to be produced by the contractor.

21.7.19 Site-specific risk assessments and the use of personal protective equipment will form a pre-requisite for workers coming onto Site. Entry into excavations or any other enclosed space on a construction site will comply with confined space legislation and be assessed prior to entry. To minimise the risk to off-site human health, general best practice guidance will be followed on Site to minimise dust generation, as outlined in "Environmental Good Practice on Site", 4th Edition, CIRIA Publication C692 (Ref 21-29) and in accordance with measures set out in the **Outline CEMP [TR030008/APP/6.5]**.

21.7.20 Potential impacts specific to contamination impacting on soil resources will be mitigated through the following measures:

a. Works will be in compliance with BS 3882:2015 'British Standard Specification for Topsoil and Requirements for Use' (2015) and the Construction Code of Practice for the sustainable use of soils on construction sites (Ref 21-65).

b. The source of topsoil will be investigated carefully with respect to its suitability for the intended use.

c. A Soil Resource Plan will be prepared by the contractor prior to the start of construction, detailing the areas and type of topsoil/subsoil to be stripped, stripping method, haul routes and the management of the soil stockpiles.

d. Topsoil will be handled only in the appropriate conditions of weather and soil moisture, and with suitable machinery.

e. The stockpiling of soils will be avoided whenever possible. Where stockpiling is unavoidable, heaps would be tipped loosely and the surface firmed and shaped to shed water.

f. Where possible, topsoil will be re-used on site as applicable.

g. The movement of traffic will be confined to designated haul routes to reduce the amount of heavy machinery going over soil materials which could cause compaction of soil materials. Such routes would exclude areas of proposed landscaping.

h. Following the completion of construction activities, agricultural land taken on a temporary basis will be restored and returned to the landowner for unrestricted agricultural use, and returned in the same agricultural condition that currently exists (refer to **Section 21.6**).

21.7.21 An Outline Soil Management Plan is provided as Appendix B to the **Outline CEMP [TR030008/APP/6.5]**.

21.7.22 If dewatering is required or trenchless techniques are required in high sensitivity groundwater environments, or if dewatering is required for open cut installation, a hydrogeological assessment will be undertaken. This will consider the impact on nearby abstractions/resources and potential draw down. A dewatering scheme will be prepared and implemented to manage water arising from the operations and water treatment prior to controlled discharge. Further information on dewatering is provided in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

21.7.23 Subject to the grant of the DCO, construction of the Project (save certain enabling works) would only be able to commence once the Final CEMP has been submitted to and approved by the Planning Authority. This will be secured by a requirement included in the draft DCO **[TR030008/APP/2.1]** and will be in accordance with the measures detailed in the **Outline CEMP [TR030008/APP/6.5]**.

Operational Phase

21.7.24 The Project will operate in accordance with and comply with relevant legislation and regulations, and the hydrogen production facility will be regulated by the EA through an Environmental Permit.

21.7.25 Potential impacts associated with the accidental spillage of polluting materials during the operational phase will be mitigated by way of process monitoring and implementation of an Environmental Management System as required by ISO14001:2015 Environmental Management Systems. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2] and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses during the operational phase.

21.7.26 Appropriate emergency environmental management plans and procedures, in accordance with legislation and regulations, will be in place for the operational stage. Operational workers will comply and adhere to appropriate site and task specific health and safety documentation required for legal compliance. Workers will comply with confined space legislation and assessments. If maintenance workers are required to undertake excavations during the operational phase, task and site-specific assessments would be undertaken for each sub area of the Site, and sufficient information will be provided for such assessments to be undertaken. Workers will be required to use personal protective equipment prior to coming onto Site. The storage of hazardous substances during the operational phase will be approved by NELC through a Hazardous Substances Consent and regulated by the Health and Safety Executive (as the competent authority) and the Environment Agency through COMAH. Further information relating to these measures is presented in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2].**

Decommissioning Phase

21.7.27 An **Outline Decommissioning Environmental Management Plan ("DEMP") [TR030008/APP/6.6]** has been prepared as part of the DCO application to explain how impacts associated with the decommissioning of hydrogen production facility will be minimised or avoided.

21.7.28 The construction workers at the Site during the decommissioning phase will follow general best practice guidance and adhere to site specific health and safety risk assessments, legislation and regulations.

21.7.29 To minimise the mobilisation of potential contaminants from material stockpiles, stockpiled material will be stored at a suitable distance from watercourses and suitably covered (if not used within three months).

21.7.30 A final DEMP will be prepared by the demolition contractor, and will contain the measures detailed in the **Outline DEMP [TR030008/APP/6.6].** The final DEMP will be secured by way of requirement in the draft DCO **[TR030008/APP/2.1].**

21.8 Assessment of Likely Impacts and Effects

21.8.1 This section discusses the likely impacts and effects identified for human health, geology and controlled waters receptors as a result of the Project.

21.8.2 As described in **Paragraph 21.4.9**, the assessment of the likely significant effects of the Project has been based on the implementation of both embedded and standard mitigation measures summarised in **Section 21.7**. Where likely significant effects are predicted to remain following the implementation of these measures, additional mitigation measures have been identified to further reduce their significance where possible.

Receptors

21.8.3 Based on a review of the baseline environment described in **Section 21.6, Table 21-18** identifies the type and location of relevant environmental receptors, detailing their relationship to the Site Boundary, their sensitivity rating, and the rationale for their inclusion in the assessment scope (i.e. where potential impact pathways exist). The assessment of ground conditions and land quality at the Site has been undertaken using previous and recent Ground Investigation data, including potential contamination sources, receptors and plausible pollutant linkages.

Table 21-18: Value (sensitivity) of Receptors

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Human Health				
Human Health	Workers and site visitors	On site	Medium	Workers and site visitors on Site are considered to be of Medium sensitivity due to the commercial/industrial land use. The workers and site visitors may be a receptor to potentially contaminated groundwater, soils and dust.
Human Health	Workers and site visitors	Off site	Medium	The workers and site visitors located off-site are considered to be of Medium sensitivity due to the commercial/industrial land use within the wider area, including the Port of Immingham. The off-site workers and site visitors may be a receptor of potential contaminated groundwater, dust and vapours that could migrate offsite.
Human Health	Residential properties within the 500m study area	Off site within 500m study area	Very high	Residents of properties within the 500m study area are considered to be very high sensitivity due to the commercial/industrial land use within the wider area, including the Port of Immingham. Residents may be a receptor of potential contaminated groundwater, dust and vapours that could migrate offsite.
Geology (Bedrock)				
Geology Bedrock	Flamborough Chalk Formation Burnham Chalk Formation	The Flamborough Chalk Formation underlies the superficial deposits across the entire Site, apart from the western Site Boundary and Kings Road Work No.10. The Burnham Chalk Formation underlies	Negligible	There are no geological exposures, and little/no local interest. The bedrock is overlain by thick superficial deposits.

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
		the western Site Boundary and Kings Road Work No.10.		
Geology Superficial				
Geology	Tidal Flat Deposits	The entire Site, apart from the bank of the Humber Estuary.	Negligible	There are no geological exposures, and little/no local interest. In some areas, the Tidal Flat Deposits are overlain by Made Ground.
Geology Superficial	Beach and Tidal Flat Deposits (Undifferentiated)	Northeastern boundary of the Site, along the bank of the Humber Estuary.	Negligible	There are no geological exposures and little/no local interest.
Geology Superficial	Devensian Till	The entire Site, underlying the Tidal Flat Deposits.	Negligible	There are no geological exposures and little/no local interest. The Devensian Till is overlain by Tidal Flat Deposits.
Soils				
Soils	Soils (Beach and Tidal Flat Deposits and Tidal Flat Deposits)	The entire Site.	Medium	The West Site and the eastern half of the Temporary Construction Area are designated as ALC Grade 3b.
Soils	Agricultural soils	Laporte Road Temporary Construction Area	Medium	Agricultural soils in this area will be left in situ and not stripped or stored, and accordingly these resources may be subject to a degree of compaction during construction (associated with the laydown of materials).

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Hydrogeology and Hydrology				
Groundwater (Bedrock)	Principal Aquifer (Chalk)	The entire Site.	Very High	The Chalk bedrock geology is designated as a Principal Aquifer, and there are multiple groundwater abstractions within a 1km radius from the Site. An SPZ1, 2 and 3 are located within the Site Boundary associated with a groundwater abstraction approximately 27m northwest from the Site. Unproductive superficial deposits may provide some protection to the Principal Aquifer. However, the borehole records indicate there are higher permeability layers of strata such as sand and warp.
Groundwater (Superficial)	Secondary (Undifferentiated) Aquifer (Beach and Tidal Flat Deposits (Undifferentiated)	Northeastern boundary of the Site, along the bank of the Humber Estuary.	Low – Medium	The Beach and Tidal Flat Deposits may support groundwater of a minor value as it is a Secondary Aquifer.
Groundwater (Superficial)	Unproductive Aquifer (Tidal Flat Deposits)	The entire Site, apart from the bank of the Humber Estuary.	Low	The Tidal Flat Deposits comprise of unproductive strata and are therefore designated as an Unproductive Aquifer.
Surface Water	Humber Estuary	The Humber Estuary is located within the Site Boundary to the northeast of the Site.	High	The Humber Estuary is a WFD waterbody with a ‘moderate’ ecological classification and a ‘fail’ chemical classification in 2019.
Surface Water	North Beck Drain catchment	The North Beck Drain is located immediately east from the Site.	High	The North Beck Drain is a WFD waterbody with a ‘moderate’ ecological classification and a ‘fail’ chemical classification in 2019.

Aspect/ Criteria	Resource/ Receptor	Location	Sensitivity	Justification
Surface Water	Habrough Marsh Drain	To the west of the Site.	High	The Habrough Marsh Drain is part of the North Beck Drain catchment, which had a 'moderate' ecological classification and a 'fail' chemical classification in 2019.

Pathways

21.8.4 The assessment has identified the following pathways as having the potential to directly and/or indirectly impact on identified receptors during the construction, operational and decommissioning phases of the Project:

a. Direct contact with contamination.

b. Inhalation of dust and/or soil derived vapours.

c. Migration of ground gas.

d. Vertical and lateral migration of contaminants via groundwater and surface run-off.

e. Soil compaction.

21.8.5 **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** considers the in-combination effects relating to the topic of ground conditions and land quality, in addition to controlled waters and human health which could arise from the Project.

Construction Impacts and Effects

21.8.6 This section contains an assessment of the likely impacts and effects on ground conditions including land quality receptors as a result of the construction phase on the Project.

21.8.7 There is potential for sediment bound contaminants of concern to be mobilised as a result of dredging operations for the marine element of the Project. These potential impacts are discussed further in **Chapter 17: Marine Water and Sediment Quality and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

Direct contact with contamination and inhalation of dust/soil derived vapours

21.8.8 Residents within the 500m study area, site visitors and on-site workers are considered the main human health receptors likely to be affected by the construction phase.

21.8.9 If contaminated soils are encountered in the course of excavation and construction works, there are likely impacts on human receptors. Construction activities on the Site including foundation construction, earthworks, excavations and movement of ground materials may expose on site workers and future site visitors to potentially contaminated dust. The construction activities may result in the removal, relocation or mobilisation of existing potential contaminants which could have an adverse effect on human health.

21.8.10 During the 2023 Ground Investigation two samples out of thirty analysed noted to contain asbestos or asbestos containing materials (“ACMs2). Both samples came from the East Site, Hydrogen Production (Works No 5).

21.8.11 The sensitivity of residents within the 500m study areas is considered to be *very high* and the magnitude of impact is considered to be *negligible.* The sensitivity of the workers on the Site is *medium* and the magnitude of impact on human health is *minor*. Accordingly, with embedded and standard mitigation measures adopted and implemented as outlined in **Section 21.7** the significance of effect from the uncontrolled release of potentially contaminated soil- derived dust, including asbestos, contaminated surface water run off or groundwater on human health receptors is considered to be **slight adverse**, which is **not significant.**

21.8.12 The construction phase may result in adverse impacts on the geology (which has a *negligible* to *low* sensitivity) and soils (which have a *medium* sensitivity) underlying the Site through the potential risk of creating new Source-Pathway-Receptor linkages. The soils on the Site could be degraded through the construction activity due to the presence of heavy plant machinery and vehicle movement. The construction phase may also result in increased soil erosion, changes in topography and ground stability impacts. Waste soils may be generated in the event that the soils cannot be reused within the Site and will hence require off-site disposal. However, standard and embedded mitigation practices will remove the potential for adverse impacts to geology and soils. Therefore, the significance of effect on geology is considered **neutral** and on soils is **slight adverse** which are both **not significant**.

21.8.13 There is potential for beneficial effects during the construction stage if any contaminated soil that is encountered is treated or removed, thereby removing the likely adverse effects on the receptor. Drainage design for the Site will also reduce the potential for soil erosion.

Migration and accumulation of ground gas

21.8.14 Ground gas has the potential to accumulate within temporary structures during the construction phase. The Ground Investigation undertaken by RSK (Ref 21-18) of the Pipeline Corridor and Queens Road Temporary Construction Area (Work No. 6 and 8) recorded elevated methane concentrations. In addition, the 2023 Ground Investigation by AECOM also observed elevated methane concentrations and high flow rates during ground gas monitoring rounds.

21.8.15 The sensitivity of human health receptors in relation to effects from accumulation of ground gas in confined spaces has been classed as *medium* with a *moderate* magnitude. With the standard and embedded mitigation practices in place it is concluded that there will be a **slight adverse** effect, which is classed as **not significant.**

Vertical and lateral migration of contaminants via groundwater and surface run-off

21.8.16 During construction there is the potential that a pathway may be created for contamination to impact controlled waters (Secondary Undifferentiated Aquifer, Unproductive Aquifer, Principal Aquifer, Humber Estuary, North Beck Drain and Habrough Marsh Drain).

21.8.17 In addition, during the construction phase potential disruption to shallow groundwater may arise as a result of excavations and foundations. Excavations may fill with groundwater and therefore require temporary groundwater controls such as physical cut-offs or dewatering. In the immediate area of the excavation, it is likely that the groundwater levels would be lowered. Preferential flow pathways for groundwater may also be created as a result of service trenches Dewatering controls may also draw contaminated groundwater on Site if any contaminated groundwater is present. This may result in changes to the hydrogeological regime and may affect the aquifers beneath the Site.

21.8.18 The bedrock aquifer has a sensitivity rating of *very high* and the magnitude of impact is considered *minor adverse*. The superficial deposit aquifers have a low to *medium* sensitivity and the magnitude of impact is considered *minor adverse*. However, it is anticipated that with standard and embedded mitigation controls in place this will lead to a **slight adverse** effect which is **not significant**.

21.8.19 There is potential for accidental spillages and leakages associated with fuels and oils from vehicular plant equipment, stored liquids and other polluting materials which could potentially be mobilised to surface water and groundwater as a result of run-off and lateral or vertical migration. With a minor adverse magnitude of effect on bedrock aquifers which have a *very high* sensitivity and superficial deposits that have a *low to medium* sensitivity and surface waters with a *high sensitivit*y, the effect of impact to controlled waters with standard and embedded mitigation controls in place is considered to be slight adverse which is not significant.

21.8.20 Preferential pathways and new Source-Pathway-Receptor linkages may be created during the construction phase, particularly if piled foundations are required through Made Ground into underlying natural soils or bedrock. The Ground Investigation site specific data identified a risk to aquifers beneath the Site from the quality of the groundwater and aggressive ground conditions. This may result in adverse impacts to the superficial (Unproductive and Secondary Undifferentiated Aquifers of the Tidal Flat Deposits and Beach and Tidal Flat Deposits respectively) which have a *low to medium* sensitivity and bedrock aquifers (Principal Aquifer of the Flamborough Chalk Formation) which have a *very hi*gh sensitivity. However, with standard and embedded mitigation controls in place the effect is considered to be **slight adverse** which is **not significant**.

Soil compaction

21.8.21 During construction, work will be necessary to prepare and improve the ground within the Laporte Road Temporary Construction Area (Work No. 9), prior to receiving materials for laydown and storage.

21.8.22 Although works at this location will be minimal, potential exists for compaction of soils resources from the process of light grading and compaction, which is required to form a level, stable surface for storage and to allow the construction workforce to safely navigate around the area.

21.8.23 As the ALC Grade 3b soils in this location will be covered and protected with breathable heavy duty ground mat protection, the assessment has identified that this *medium sensitivity* receptor will experience a *minor adverse* magnitude of impact (as effects will be temporary) with this matting in place. The effect of this will be **slight adverse** which is **not significant**.

Loss of Soil Resource

21.8.24 Work No. 7 on the West Site would take place on an area of fields, which were formerly used for agricultural purposes, but the agricultural use has ceased.. The area is allocated in the Local Plan for light industrial use. The area benefits from an extant planning permission for light industrial development and an entrance and spine road has been put in place pursuant to that permission to facilitate that development. The soils are considered to be agricultural grade 3b. However, some loss of fertility associated with cessation of the agricultural use is assumed. The sensitivity of grade 3b agricultural soils is *medium*. In terms of the impact of the Project on the soil resource, the cessation of agricultural use has already taken place and planning permission for light industrial development of this site has been obtained and implemented, including some loss of soil resource. Given this, the effect of the Project is considered to be **slight adverse** and **not significant**.

Operational Impacts and Effects

21.8.25 This section contains an assessment of the likely impacts of the operational phase on the Project.

21.8.26 The following impact pathways have been assessed prior to the implementation of mitigation measures and then appropriate mitigation measures are identified:

a. Direct contact with contamination.

b. Inhalation of dust and/or soil derived vapours.

c. Migration of ground gas.

d. Vertical and lateral migration of contaminants via groundwater and surface run-off.

Direct contact with contamination and inhalation of dust / soil derived vapours and ground gas

21.8.27 Although future on site workers and site visitors are anticipated to spend longer durations of time on the Site than construction and maintenance workers, it is anticipated that direct contact and inhalation will be unlikely due to the presence of hardstanding on the Site which will remove the pathway in the pollutant linkage. Direct contact and inhalation are also considered unlikely as standard and embedded mitigation practices will be in place. Therefore, it is considered that the effect will be **neutral** which is **not significant**.

21.8.28 The geology and soils beneath the Site are unlikely to be receptors during the operational stage as the Site will be covered in hardstanding and site drainage will have been designed which will remove the pathway in the pollutant linkage. The effect is considered to be **neutral** which is **not significant**.

Migration and accumulation of ground gas

21.8.29 During operation ground gas may accumulate and migrate beneath the structures built within the Site due to the presence of Made Ground, warp and organic deposits and bedrock beneath the Site and landfills in the vicinity of the Site. However, standard and embedded mitigation measures will mean that the effect is considered to be **neutral** which is **not significant**.

Vertical and lateral migration of contaminants via groundwater and surface run-off

21.8.30 There is potential for accidental spillages and leakages from the handling of fuels, lubricants, stored chemicals and process liquids and infrastructure on the Site (pipelines, tanks and storage facilities) during the operational phase which may affect groundwater and surface water via surface run-off and lateral and vertical migration if appropriate mitigation measures are not applied. However, the Site will be operated in accordance with standard and embedded mitigation practices to control any likely impacts. Therefore, the effect is considered to by **neutral** which is **not significant**.

Decommissioning Impacts and Effects

21.8.31 This section contains an assessment of the likely impacts of the decommissioning phase of the hydrogen production facility on the Project.

21.8.32 The following impact pathways have been assessed prior to the implementation of mitigation measures:

a. Direct contact with contamination.

b. Inhalation of dust and/or soil derived vapours.

c. Vertical and lateral migration of contaminants via groundwater and surface run-off.

Direct contact with contamination and inhalation of dust / soil derived vapours and ground gas

21.8.33 Human health receptors (future on site workers and site visitors) may be affected during the decommissioning stage if the ground is broken to remove the above ground structures on the Site. If there is any contamination beneath the Site, the decommissioning works may result in the removal, relocation or mobilisation of existing potential contaminants which could have an adverse effect on human health. However, the Site will be operated in accordance with standard and embedded mitigation controls which will result in a **slight adverse** effect which is **not significant**.

21.8.34 The breaking of ground during the decommissioning phase may result in the creation of new Source-Pathway-Receptor linkages which may have an adverse impact on the geology and soils underlying the Site. If there are any contaminants on the Site, the breaking of ground to remove above ground structures may result in the mobilisation of contaminants. Heavy plant and machinery and vehicle movements may degrade the soils on the Site. However, this is considered unlikely as any effects on the soils would have occurred during

the construction of the Project. Furthermore, the Site will be operated in accordance with standard and embedded mitigation controls and the effect is considered to be **slight adverse** which is **not significant**.

Vertical and lateral migration of contaminants via groundwater and surface run-off.

21.8.35 Following the Ground Investigation, it is concluded that where piling or other deep foundations or a form of ground improvement is to take place, the detailed construction methodology will be assessed to reduce the risk of the development of preferential pathways (e.g. groundwater flow) between the Made Ground present and the underlying Secondary superficial aquifers and Principal bedrock aquifers. Through standard and embedded mitigation practices it is considered that there will be a **slight adverse** effect which is **not significant**.

21.8.36 There is potential for accidental spillages and leakages from plant and machinery, as well as fuels, stored chemicals, process liquids and lubricants that are stored and used on Site during the decommissioning phase. These may migrate via surface run-off and lateral and vertical migration to surface water receptors and groundwater receptors respectively. However, the Site will be operated in accordance with standard and embedded mitigation practices and the effect will be **slight adverse** which is **not significant**.

21.8.37 The removal of structures on the Site may require dewatering, which could have an adverse effect on the hydrogeological regime, such as the lowering of groundwater. However, the Site will be operated in accordance with standard and embedded mitigation practices and controls which will result in a **slight adverse** effect which is considered **not significant**.

21.8.38 During the decommissioning stage, there is potential for run-off associated with stockpiled material that is not covered, migrating to nearby surface watercourses and groundwater beneath the Site. However, the Site will be operated in accordance with standard and embedded mitigation measures which will have a **slight adverse** effect which is considered **not significant**.

21.9 Mitigation and Enhancement Measures

21.9.1 The assessment presented in **Section 21.8** has indicated there is a slight adverse effect with regards to the loss of agricultural grade 3b soils within the West Site (Work No. 7) as a result of the Project, however the soil loss is already assumed with the cessation of the agricultural use and through the change of land use. The assessment has indicated that no other significant effects with regards to ground conditions and land quality are anticipated and therefore, no additional mitigation, monitoring or enhancement measures other than those set out in **Section 21.7** are considered necessary.

21.10 Assessment of Residual Effects

21.10.1 Based upon the assessment as detailed in **Section 21.8**, there are no significant residual effects anticipated with regards to human health, geology, soils, groundwater and surface water receptors.

21.11 Summary of Assessment

21.11.1 In summary, the likely receptors of the Project include human health, geology, soils and controlled waters.

21.11.2 The assessment demonstrates that the construction phase, operational phase and decommissioning phase will result in no significant effects. A summary of the ground condition and land quality impacts, mitigation measures and residual effects is provided in **Table 21-19**.

Table 21-19: Summary of impact pathways, mitigation measures and residual effects

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Construction Phase						
Human Health Onsite workers Site visitors Residents	Direct contact with contaminated soils, exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Construction works will be carried out in accordance with the CEMP, site specific health and safety legislation and regulations and general best practice guidance. Workers will be required to wear PPE. Asbestos has been encountered during the GI. An Outline AMP has been prepared as part of this ES. The Ground Investigation data has been used to inform land contamination risk assessments. An Outline Remediation Strategy **[TR030008/APP/6.4]** has been prepared to define mitigation measures for significant contamination and will outline how earthworks will be undertaken. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Human Health Offsite workers Site visitors Residents	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours and ground gas.	Construction works will be carried out in accordance with the CEMP, site specific health and safety legislation and regulations. Works will also adhere to general best practice guidance such as "Environmental Good Practice on Site", 3rd Edition, CIRIA Publication C762 (Ref 21-29) to minimise dust generation off-site. The Ground Investigation data has been used to inform land contamination risk assessments. An Outline Remediation Strategy has been prepared to define mitigation measures for significant contamination and outlines how earthworks will be undertaken. An Outline AMP has been prepared as part of this ES. An MMP will also be implemented to classify, track, store, dispose and potentially re-use excavated materials encountered.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Geology Beach and Tidal Flat Deposits Tidal Flat Deposits	Piling foundations	Construction works will be carried out in accordance with the CEMP. The construction methodology will be assessed and Piling Risk Assessments will be prepared and implemented.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Devensian Till Flamborough Chalk Formation		Environmental good practice will be adhered to on site.				
Soils Beach and Tidal Flat Deposits Tidal Flat Deposits	Spoil arising from earthworks and excavations and degradation due to plant heavy plant machinery and vehicle movement. Loss of potential versatile agricultural land.	An ALC Survey has been undertaken. The survey indicates the West Site and a thin strip of land within the Laporte Road Temporary Construction Area (Work No. 9) is classified as ALC Grade 3b. The following standards will be adhered to during earthworks operations: with BS1997:2004 Eurocode 7 (Ref 21-27), BS16907-1 to 7:2018 Earthworks (Ref 21-26); BS6031:2009 Code of Practice for earthworks (Ref 21-27) and National Highways (NH) guidelines including DMRB Series 600 'Earthworks' (Ref 21-28). An Outline Remediation Strategy has been prepared and is provided as **Appendix 21.C [TR030008/APP/6.4]**. Any surplus material will be re-used where possible, subject to the requirements within the Remediation Strategy and the MMP.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Soils Agricultural soils (temporary use)	Temporary compaction of existing ALC Grade 3b soils within the Laporte Road Temporary Construction Area during construction, resulting from soil levelling/compaction operations, and from the storage of materials.	Application of breathable, heavy duty ground mat protection on top of levelled and compacted soils, prior to the laydown of materials.	Slight Adverse (Not significant)	N/A	Slight adverse (Not Significant)	High
Soils Agricultural soils (permanent loss)	Permanent loss of existing ALC Grade 3b soils within the West Site, Work Nos 7 (including 7A to 7D) during construction of the Hydrogen Production and Liquefaction, storage and tanker loading area	There are no mitigation measures for the permanent loss of soil resource	Slight Adverse (Not significant)	N/A	Slight adverse (Not Significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	and hydrogen refuelling station.					
Groundwater (Superficial Contamination) Beach and Tidal Flat Deposits (Secondary Undifferentiated Aquifer)	Vertical and lateral migration of contaminants via groundwater and surface run-off associated with: Potential vertical migration of spills and leakages. Potential for contaminant mobilisation during construction. Potential for creation of new preferential pathways and contaminant pathways. This may arise from piling, exposure of soils, increased	The Ground Investigation has obtained geo-environmental data including groundwater levels and quality. The Ground Investigation data has informed the land contamination risk assessments. Marginal exceedances of the DWS were recorded in the East Site (Work No. 3, 4 and 5) for metals and inorganics within the Tidal Flat Deposits and Flamborough Chalk Formation. A potential risk to groundwater was identified associated with inorganics in groundwater, particularly for ammonium, nitrate, sodium and chloride within shallow groundwater. No exceedances were recorded in the West Site (Work No. 7). Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Any proposed piling works would be subject to foundation risk assessments (e.g., a Piling Risk Assessment) and should be undertaken in accordance with best practice guidance. Piling method statements should detail measures to	Neutral/Slight Adverse (Not significant)	N/A	Neutral / Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	rainwater infiltration due to ground cover changes and excavations.	protect the aquifer if there is potential to cause pollution. A hydrogeological assessment and a dewatering scheme will be applied and implemented if dewatering is required or trenchless techniques are required in high sensitivity groundwater environments.				
Groundwater (Bedrock Contamination) Flamborough Chalk Formation and Burnham Chalk Formation (Principal Aquifer)	Vertical and lateral migration of contaminants via groundwater and surface run-off associated with: Potential vertical migration of spills and leakages. Changes to the hydrogeological regime. Potential for contaminant mobilisation during construction.	The Ground Investigation has obtained geo-environmental data including groundwater levels and quality. The Ground Investigation data has informed the land contamination risk assessments. Marginal exceedances of the DWS were recorded in the East Site (Work No. 3, 4 and 5) for metals, TPH and PAHs. A potential risk to groundwater was identified associated with metals and inorganics in groundwater, particularly for ammonium, nitrate, sodium and chloride within the Flamborough Chalk Formation. No exceedances were recorded in the West Site (Work No. 7). Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Any proposed piling works would be subject to foundation risk	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	Potential for creation of new preferential pathways e.g. during piling.	assessments (e.g., a Piling Risk Assessment) and should be undertaken in accordance with best practice guidance. Piling method statements should detail measures to protect the aquifer if there is potential to cause pollution. A hydrogeological assessment and a dewatering scheme will be applied and implemented if dewatering is required or trenchless techniques are required in high sensitivity groundwater environments.				
Surface Water (Contamination) Humber Estuary	Potential for run-off associated with exposed ground and material stockpiles into the Humber Estuary. Surface run-off associated with spills and leakages from vehicles or stored materials into the Humber Estuary.	Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Stockpiled materials will be stored at a suitable distance from surface watercourses to prevent run-off and should be suitability covered or reseeded if the stockpiled materials are not used within three months. Washing of plant and materials will only be undertaken in controlled areas. **Chapter 17 Marine Water and Sediment Quality** and **Chapter 18 Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discusses	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
	Direct disturbance of the riverbed or bank.	further guidance relating to the control of water pollution from construction sites.				
Surface Water (Contamination) North Beck Drain (waterbody and catchment) including the Habrough Marsh Drain	Potential for run-off associated with exposed ground and material stockpiles. Surface run-off associated with spills and leakages from vehicles or stored materials into the North Beck Drain on the eastern perimeter of the Site and the Habrough Marsh Drain to the west of the Site. This may affect the wider North Beck Drain catchment.	Construction works will be carried out in accordance with the CEMP and best practice guidance to minimise potential spillages and mobilisation of contaminants. Stockpiled materials will be stored at a suitable distance from surface watercourses to prevent run-off and should be suitability covered or reseeded if the stockpiled materials are not used within three months. Washing of plant and materials will only be undertaken in controlled areas. **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** discusses further guidance relating to the control of water pollution from construction sites.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Operational Phase						
Human Health (Contamination)	Exposure to contaminated	Operations will be required to comply with the relevant legislation and regulations, including	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Future on site workers	groundwater and exposure/inhalation of dust/soil derived vapours and ground gas.	the Environmental Permit, Hazardous Substance Consents, site and task specific health and safety documentation required for works undertaken at the Site. As a result, significant effects are considered to be unlikely. Workers will be required to use personal protective equipment prior to coming onto Site and will comply with confined space legislation and assessments.				
Human Health (Contamination) Future site visitors Off-site workers	Exposure to contaminated groundwater and exposure/inhalation of dust/soil derived vapours and ground gas.	The human health of future site visitors and off-site workers does not require mitigation measures as the operation of the Project is unlikely to cause significant effects to off-site receptors. Compliance with the Environmental Permit, Hazardous Substance Consents, site and task specific health and safety documentation required for works undertaken at the Site will minimise any effects to off-site workers and future site visitors.	Neutral/Slight Adverse (Not significant)	N/A	Neutral / Slight Adverse (Not significant)	High
Geology (Contamination)	Exposure to potential contaminants arising from spillages and leakages on the Site	No mitigation measures are required as the Site will be covered in hardstanding / impermeable surfacing, and it is assumed that the Site will be	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Superficial Deposits and Bedrock	that migrate vertically into the geology underlying the Site.	operated in accordance with an Environmental Permit and Hazardous Substance Consents.				
Controlled Waters (Contamination) Superficial Secondary Aquifer Principal Bedrock Aquifer Humber Estuary North Beck Drain and wider catchment (including the Habrough Marsh Drain)	Surface run-off and lateral / vertical migration arising from potential accidental spillages and leakages from handling of fuels, lubricants, and stored chemicals. This may impact surface waters and groundwater.	The Project will be operated in accordance with an Environmental Permit, Hazardous Substance Consents and there will be a managed surface drainage system and bunding as part of the Project. **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** discusses further standard mitigation measures to prevent and minimise potential pollution to surface watercourses.	Neutral (Not significant)	N/A	Neutral (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Decommissioning Phase						
Human Health (Contamination) Future site workers	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	A DEMP will be prepared and implemented at the Site. Workers will comply with standard mitigation, use personal protective equipment and comply with site-specific health and safety assessments and legislation. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Human Health (Contamination) Off-site workers Site visitors	Exposure to contaminated groundwater and exposure / inhalation of dust / soil derived vapours.	A DEMP will be prepared and implemented at the Site. Workers will comply with general best practice on site, use personal protective equipment and comply with site-specific health and safety assessments and legislation. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.	Slight Adverse (Not significant)	N/A	Slight Adverse (Not significant)	High
Geology (Contamination)	Exposure to potential contaminants arising	Works will comply with standard and embedded mitigation guidance and the DEMP for the Site.	Neutral Adverse (Not significant)	N/A	Neutral Adverse (Not significant)	High

Receptor which will also require a decommissioning plan to be approved by the regulator	Impact Pathway	Embedded/Standard Mitigation Measures	Effect	Additional Mitigation Measures	Residual Effect	Confidence
Superficial Deposits and Bedrock	from spillages and leakages on the Site that migrate vertically into the geology underlying the Site.	It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator.				
Controlled Waters (Contamination) Superficial Secondary Aquifer Principal Bedrock Aquifer Humber Estuary North Beck Drain and wider catchment (including the Habrough Marsh Drain)	Surface run-off and lateral / vertical migration arising from potential accidental spillages and leakages from handling of fuels, lubricants, stored chemicals may impact surface waters and groundwater.	Works will comply with standard and embedded guidance and the DEMP for the Site. Material stockpiles will be located a suitable distance from watercourses and will be suitably covered if not used within three months to prevent mobilisation and run-off. It is anticipated that the Project will be operated in accordance with an Environmental Permit which will also require a decommissioning plan to be approved by the regulator	Neutral/Slight Adverse (Not significant)	N/A	Neutral / Slight Adverse (Not significant)	High

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 22: Major Accidents and Disasters

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 22: Major Accidents and Disasters

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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22 Major Accidents and Disasters

22.1 Introduction

22.1.1 This chapter presents the findings of an assessment to determine the likely significant adverse effects of the Project on human health, welfare and/or the environment as a result of major accident and/or disaster ("MA&D") scenarios which are relevant to the Project.

22.1.2 The Institute of Environmental Management and Assessment ("IEMA") publication "Major Accidents and Disasters in Environmental Impact Assessment ("EIA"): A Primer" (Ref 22-2) comprises the key guidance document for the assessment of MA&D, and defines these as:

a. *"A major accident is an event (for instance, train derailment or major road traffic incident) that threatens immediate or delayed serious effects to human health, welfare and/or the environment and requires the use of resources beyond those of the client or its appointed representatives (e.g. contractors) to manage."*

b. *"A disaster is a man-made/external hazard (such as an act of terrorism) or a natural hazard (such as an earthquake) with the potential to cause an event or situation, which meets the definition of a major accident above."*

22.1.3 In relation to the Project, relevant scenarios are those which could credibly arise during its construction, operation and decommissioning phases.

22.1.4 The potential adverse effects of the Project derive from its vulnerability to relevant MA&D, which is the potential for harm to occur as a result of the event. The assessment of vulnerability considers the consequences of the MA&D scenario and the sensitivity of the receptor (for example humans).

22.1.5 Effects are defined primarily on a qualitative basis by the nature of their consequences, size, and/or location. Potential MA&D scenarios which, following an initial assessment are deemed credible, are termed 'MA&D risk events'.

22.1.6 Where MA&D risk events cannot be eliminated, appropriate mitigation of their adverse effects must be considered. This chapter includes a description of the measures embedded into the Project design to prevent or mitigate potential significant adverse effects of MA&D risk events and contains a description of the preparedness for (and response to) such risk events.

22.1.7 The Health and Safety Executive ("HSE") have established the concept of "*reasonably practicable*" as the risk-reduction goal for duty-holders established within the Health and Safety at Work etc. Act 1974 (Ref 22-1). The mitigation measures associated with MA&D risk events must therefore be suitable and sufficient to reduce the risk of the event to a level that can be demonstrated to the HSE is 'as low as reasonably practicable' ("ALARP").

22.1.8 This assessment of MA&D has considered the findings of other key studies reported in the Environmental Statement ("ES") to: establish flood risk; marine navigation risks; and identify environmental and human health receptors relevant to the Project and their vulnerability. Accordingly, information within the following chapters of the ES **[TR030008/APP/6.2]** has been referenced in the MA&D assessment:

a. **Chapter 12: Marine Transport and Navigation**.

b. **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage**.

c. **Chapter 24: Human Health and Wellbeing**.

22.1.9 This chapter is supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 22.1:** Major Accidents and Disasters Study Area.

22.1.10 The assessment references relevant consents and notifications associated with MA&D that will be required in order for the Project to satisfy other regulatory regimes outside of the Development Consent Order ("DCO") application process. These include:

a. Hazardous Substances Consent – an application for Hazardous Substances Consent has been prepared by Air Products and submitted to North East Lincolnshire Council ("NELC").

b. Competent Authority notification – to ensure compliance with Regulation 6(1) of The Control of Major Accident Hazards Regulations 2015 ("COMAH Regulations") (Ref 22-3) Air Products will formally notify the Competent Authority (HSE and Environment Agency "EA") prior to commencement of construction of the establishment. A further notification will be made by Air Products prior to commencing operation of the establishment.

c. HSE notification – to ensure compliance with Regulation 20 of the Pipeline Safety Regulations 1996 (Ref 22-6) ("PSR"), Air Products will formally notify the HSE prior to commencement of construction of the pipelines. A further notification will be made by Air Products to comply with Regulation 21 of the PSR, prior to commencing operation of the pipelines.

Project Expertise

Air Products (BR) Limited ("Air Products")

22.1.11 The hydrogen production facility will be operated by Air Products who have significant experience and expertise (Founded in 1940, Air Products develops, engineers, builds, owns and operates some of the world's largest industrial gas projects), in industrial gas manufacture including hydrogen production and are the world's largest supplier of hydrogen. The company develops, builds and operates facilities in over 50 countries worldwide, employing over 20,000 people, 1,500 of which work in the UK. Globally, Air Products own and operate 80 hydrogen manufacturing plants and over 700 miles of hydrogen pipework and have established a reputation for reliability and safe operation. As a competent operator, all plant and equipment will be controlled under an appropriate safety

management system applicable to a level required to satisfy the COMAH Competent Authority (HSE and EA) with regard to a COMAH installation.

22.1.12 Air Products is a member of a number of industry organisations which share knowledge and best practice associated with hydrogen operations. These include:

a. The Hydrogen Council which was launched in 2017 by 13 founding members and now comprises over 150 organisations who collaborate in the development of hydrogen technology.

b. Hydrogen Europe which is an association representing the interest of the hydrogen industry with a number of objectives including the promotion and coordination of research, development and innovation of clean hydrogen technologies.

c. European Clean Hydrogen Alliance which was established in 2020 with a broad remit to support the clean hydrogen industry to develop good practice and policy recommendations.

d. European Industrial Gases Association ("EIGA") established in 1930 which helps establish and promote technical standards in the area of safety, health, environmental issues and standardisation, alongside the other major Associations, the Compressed Gas Association ("CGA"), the Asia Industrial Gases Association ("AIGA") and the Japanese Industrial and Medical Gases Association ("JIMGA") have launched a website – the Hydrogen Ecosystem – which is accessible at H2safety.info.

e. British Compressed Gases Association established more than 40 years ago which helps establish and promote UK specific technical standards in the area of safety, heath, environmental and regulatory standardisation.

22.1.13 Air Products has over 30 years' experience operating in the Humberside area, with several industrial gas manufacturing and distribution sites including facilities at Saltend, Hull and in Stallingborough, a short distance from the Site.

22.1.14 Liquid hydrogen was developed from laboratory to industrial scale in the 1950s. Air Products started production of liquid hydrogen in 1957 with the first large scale plant built in west Palm Beach in 1959. This was then followed by two more plants in the early 1960s, with other plants following in the 1970s and 1980s. Air Products' newest hydrogen manufacturing plant is in LaPorte, Texas, which came on stream in 2021 and produces up to 30 tonnes a day.

22.1.15 Transport and storage of hydrogen is a common process that Air Products has been carrying out for many years. Nearly all of Air Products' hydrogen facilities have associated onsite storage with vehicle filling and delivery systems. Consequently, the organisation can draw on many years of expertise and experience in hydrogen operations which will be invaluable to the Project.

Associated British Ports ("ABP")

22.1.16 The jetty facilities will be operated by ABP who are one of the UK's leading ports groups, owning and operating 21 ports across England, Wales and Scotland. ABP's principal operations, handling oil and petroleum products are located on the Humber. Immingham Oil Terminal supports major refineries which supply a significant proportion of the nation's petroleum and fuel, whilst the Port of Hull houses the chemical site to store businesses' product requirements and supply the PX Saltend Chemicals Park. Other liquid bulk handling infrastructure can be found at the Eastern and Western Jetties and enclosed dock basin at the Port of Immingham, and similarly within the enclosed dock basins at the Port of Hull.

22.1.17 The Port of Immingham is operated by ABP and is the UK's largest port by tonnage and has been in operation for over 100 years.

22.1.18 ABP's Health and Safety Policy Statement includes a commitment to compliance with the requirements of the Port Marine Safety Code (Ref 22-26), the Railways and Other Guided Transport (Safety (Amended) Regulations 2011) (Ref 22-38), the Merchant Shipping Act 1995 (Ref 22-39), the Pilotage Act 1987 (Ref 22-40) and the Safety in Dock Approved Code of Practice ("ACOP") and Guidance (Ref 22-41).

22.1.19 Embedding a safety-led culture is a critical aspect of ABP's operations with the aim of eliminating harm and creating a great place to work for all employees. The continuous emphasis on behavioural safety has involved colleagues taking part in an extended range of safety culture and leadership courses.

22.1.20 ABP are also deploying new technologies, such as Virtual Reality, to help increase awareness of safety issues amongst colleagues.

22.2 Consultation and Engagement

22.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the MA&D assessment, and the approach and methods to be followed.

22.2.2 The outcomes of this exercise were recorded in a Scoping Report **[TR030008/APP/6.4]**, which detailed the technical guidance, standards and best practice to be applied in the assessment to identify and evaluate the likely significant effects of the Project in relation to MA&D.

22.2.3 A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**; this confirmed the assessment scope and identified a number of matters that the Planning Inspectorate and consultees deemed relevant for consideration in the assessment.

22.2.4 The first Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act") (Ref 22-42). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised as part of this consultation.

22.2.5 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and ongoing design-development and assessment, a series of changes to the Project were identified. A second Statutory Consultation took place between 24 May 2023 and 20 July 2023 in accordance with the 2008 Act (Ref 22-42) and a PEI Report Addendum was publicised, accompanying this second consultation.

22.2.6 Consultation undertaken with statutory consultees to inform this assessment, including a summary of comments raised within the Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4]**) and those returned in response to the formal consultation and other pre-application engagement is summarised in **Table 22-1.**

Table 22-1: Consultation Summary Table

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	The Scoping Report states that study area for the assessment of major accidents and disasters is not defined within regulatory guidance or standardised methodology, but that the study area is based on experience and judgement and includes nearby major hazard sites, pipelines other sites whose land use planning zones may encroach on any part of the Proposed Development. The ES should contain a robust justification to support the chosen study area and sensitive receptors selected for the purposes of the ES assessment, based on professional guidance such as that published by IEMA. The study area should be consulted on and agreed with relevant consultation bodies where possible. Figure 2.1 in Appendix A is stated to provide a figure showing the site boundary with respect to infrastructure and industrial sites and natural features and protected environmental sites, however this does not appear to map any major hazard sites or receptors near to the Proposed Development. A figure showing relevant receptors and potential major hazard risks should be provided in the ES.	**Figure 22.1 [TR030008/APP/6.3]** presents the study area and identifies key receptors, infrastructure and existing major accident installations. Information has been included in **Section 22.6** to describe receptors including other COMAH installations and environmental receptors including groundwater vulnerability. A radius of 5km from the Site Boundary has been used to define the study area, explained further in **Section 22.5**. The extent of the Site Boundary has been refined following the submission of the Scoping Report; these modifications have been assessed to have no impact on the study area. No specific comments on the geographic extent of the study area were made by consultees during scoping; however, **Section 22.5** includes a more detailed description of the area within 5km of the Site supported by **Figure 22.1 [TR030008/APP/6.3]**.
		The assessment should consider the vulnerability of the Proposed Development to a potential accident or disaster and the Proposed Development's potential to cause an accident or disaster including the use of Very Large Gas Carriers (VLGCs). The ES should also provide consideration of future hazards associated with transportation and storage of CO_2.	The future use of Project facilities to transport and/or store carbon dioxide (CO_2) has been described, noting that CO_2 is another bulk liquid (in addition to ammonia) that is likely to be used at the new terminal in future. Specific proposals are being developed for the import and export of liquified CO_2 from carbon capture and storage projects elsewhere, but these are at an early stage and would be subject to separate

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The assessment should consider how any surrounding hazardous installations may impact on the major accident hazards arising from the Proposed Development's site operation. Any assessment should include consideration of the impact on surrounding hazardous installations including potential cumulative effects from multiple major accidents which the Proposed Development could become part of cumulatively. Where qualitative assessments are made the professional qualifications and experience of the assessors should be made clear in the ES.	applications for consents for associated landside development and any permits as may be necessary. There are no chemical incompatibilities which would prevent facilities such as the jetty from handling CO_2, as well as hydrogen and ammonia. There would be engineering equipment, systems and procedures in place to prevent these liquified products coming into contact such as isolation valves and vents. CO_2 is not a prescribed substance under COMAH and ALARP measures and emergency planning for accident scenarios involving both CO_2 and ammonia on the jetty are no more onerous than those for ammonia in isolation (see **Paragraph 22.8.14**). Potential effects to and from nearby major accident hazard pipelines and installations have been described and considered throughout the chapter, in particular in **Table 22-4** and **Table 22-5**, and in **Section 22.8**. The potential for a 'domino' event to have an impact on several sites cumulatively has been assessed in **Section 22.8** following Quantitative Risk Assessment ("QRA") and consequence modelling. The qualifications and experience of the author of the MA&D assessment is included in **Appendix 1.E [TR030008/APP/6.4]**.
	Health & Safety Executive	According to HSE's records the proposed site is in the vicinity of a number of major accident hazard installations with Hazardous Substances Consent. Given the nature of the proposal the site will need to consider all the major hazards associated with its proposed operations including both the impact on the surrounding hazardous Installations and how these installations may impact on the major	The chapter includes a detailed description of industrial neighbours and the potential for domino events. The potential hazards of existing operational facilities such as COMAH sites and major accident hazard pipelines have been considered during construction, operation and future decommissioning within Risk Event 13.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		accident hazards arising from the site operation. The site would likely need to be included in a domino group of sites. Also according to our records the site is in close proximity to a major hazards pipeline operated by Cadent Gas ltd. It is noted that the EIA recognise the potential impact of these major hazard operations on to the site, but consideration also needs to be given to the impact of the site onto these sites through the lifecycle of the facility including construction.	Detailed hazard analysis such as QRA and consequence modelling has been undertaken to refine the assessment of potential domino effects as set out in **Section 22.8**.
		The proposal laid out in the EIA recognises the operation of the [Project] will involve the presence of hazardous substances on, over or under land at or above set threshold quantities (Controlled Quantities) will therefore require Hazardous Substances Consent (HSC) under the Planning (Hazardous Substances) Act 1990 as amended, as set out in The Planning (Hazardous Substances) Regulations 2015 as amended. Table 21.3 of the EIA recognises that HSC would be required given the proposal involves the handling of Named Hazardous Substances or Categories of Substances at or above the controlled quantities set out in Schedule 1 of these Regulations. The proposal also recognises the site will be within the scope of Control of Major Accident Hazard Regulations 2015 and will therefore require notification to the COMAH Competent Authority prior to construction. However, what is not identified in this table is whether notification is required under the Pipelines Safety Regulations 1996 in relation to the construction and operation of the pipelines that are proposed within the application. It is recommended that details of the proposed	The chapter includes details of the requirement for the Project to comply with the Pipelines Safety Regulations 1996 (Ref 22-6) (“PSR”). Pipelines containing hydrogen and ammonia are within the definition of dangerous substances contained within the PSR; therefore specific controls described in the PSR will apply to these. The applicability of legislation pertinent to the assessment, including the PSR, is presented in **Table 22-2**. This chapter confirms that the operator of the pipelines would fulfil all statutory requirements for compliance with the PSR, including the production of a Major Accident Prevention Document(s) (“MAPD”) and the appropriate emergency plans.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		pipelines and whether they come within the scope of PSR are included in future consultation documentation.	
	Environment Agency	The Environment Agency will have a role in regulating the site in line with COMAH and has no comments to make on the proposed assessment for planning purposes. However, we welcome the acknowledgement that the proposed development will present major accident hazards and identifies the importance of the Humber as a receptor.	The Environment Agency's response is noted, and the Humber Estuary has been identified as a MADs receptor (**Table 22-4**).
	North East Lincolnshire Council	Thank you for the opportunity to comment on the submitted EIA Scoping report provided by the Applicant. On the whole NELC are content with the scope of the proposed EIA, responses from internal consultees are provided at the bottom of this letter. NELC would like to highlight the importance of fully understanding and considering the extent of any Hazardous Zones associated with the development and the land use planning implications of such zones. This should be through consultation with the Health and Safety Executive.	The HSE is a statutory consultee during the planning process. The land use planning implications of the Project are addressed in this assessment. The Site is within the consultation distances of a number of major hazard sites and pipelines; this is a key factor which has been taken into account in the assessment and through consultation with the HSE.
PEI Report (Statutory Consultation) January 2023	Environment Agency	Paragraph 4.6.5 correctly identifies that the development will require a permit to operate under The Environmental Permitting (England and Wales) Regulations 2016 and will also fall to be regulated under The Control of Major Accident Hazards Regulations 2015. We have noted form the information in the PEI Report that it is intended to use natural gas as fuel in some parts of the production process. This is something that we will review further and is likely to be a topic that will need to be discussed during the pre-application stage for the environmental permit.	An Environmental Permit application for the Project is currently being developed. A COMAH notification was submitted to the HSE on 5 April 2023. The hazards associated with the use of natural gas have been considered, with associated risk reduction and mitigation measures identified. These measures include compliance with the Dangerous Substances and Explosive Atmospheres Regulations ("DSEAR") 2002 (Ref 22-9).

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Local Resident (living within approx. 10km of the Project)	Concern expressed about the danger associated with the storage and transport of hydrogen.	Risk assessments have been carried out by the Project team to identify and mitigate any hazards associated with the storage and transport of hydrogen (see **Section 22.8**). During the development and operation of the Project facilities, the risks associated with the production and storage of hydrogen will be appropriately managed through a comprehensive safety and environmental protection programme. This is implemented via engineering design, operational procedures and management to achieve a level of risk which can be demonstrated to be ALARP, as required by regulations applicable to the Project, including COMAH (Ref 22-23), Environmental Permitting (Ref 22-24), Hazardous Substances (Ref 22-7) and the PSR (Ref 22-6). Transport of hydrogen to users via the road network will comply with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations ("CDG") SI 2009 No 1348 (Ref 22-23). These regulations impose a highly structured and prescriptive regime for transport of materials such as hydrogen, covering requirements such as packaging, loading, crew and vehicle requirements. Compliance with these regulations will appropriately manage the risk associated with transport of hydrogen.
	Local Resident (living within approx. 10km of the Project)	Concern expressed about the storage and potential release of ammonia with prevailing north easterly winds carrying gas over Immingham.	Risk assessments have been carried out by the Project team to identify and mitigate any hazards associated with the storage of ammonia. These studies are described in **Section 22.8**. **Section 22.6** describes the hazards of ammonia and key safety systems associated with its delivery, storage and use.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			During the development and operation of the Project, the risks associated with the production and storage of hydrogen will be appropriately managed by a comprehensive safety and environmental protection programme. This is implemented via engineering design, operational procedures and management to achieve a level of risk which can be demonstrated to be ALARP, as required by regulations applicable to the Project, including COMAH, Environmental Permitting, Hazardous Substances and Pipeline Safety Regulations.
	Local Resident (living within approx. 10km of the Project)	Concern expressed over the potential for loss of life of Immingham residents due to explosion.	From a human health perspective, perception of risk has been considered within **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**. During the development and operation of the Project, the risks associated with the production and storage of flammable substances with the potential to form explosive atmospheres will be appropriately managed by a comprehensive safety and environmental protection programme. This is implemented via engineering design, operational procedures and management to achieve a level of risk which can be demonstrated to be ALARP, as required by regulations applicable to the Project, including COMAH, Environmental Permitting (Ref 22-24), Hazardous Substances and the PSR (Ref 22-27). A preliminary hazardous area assessment has been carried out for the Project in accordance with an industry standard guidance document published by the Energy Institute (Ref 22-28). The purpose of this assessment and its importance in the engineering design process is described in **Section 22.8**.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Local Resident (living within approx. 10km of the Project)	The hydrogen plant is further development of the agricultural land which has historically provided a buffer between port/industry and residential town. The proposed development, handling & storing of dangerous and toxic chemicals, is within 500m of housing estates in Immingham. Any large scale incident has potential for a domino effect with all of the existing COMAH sites in the area.	From a human health perspective, perception of risk has been considered within **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**. A suitable location for the hydrogen production facility within and around the Port was identified taking into account all available space, the Port's existing development plans, ground conditions, presence of existing structures and services including existing transport corridors, proximity to residential conurbations, access, and proximity to the jetty. The two plots of land identified as the proposed location of the hydrogen production facility were selected as the most suitable. Further details are given in **Chapter 3: Needs and Alternatives [TR030008/APP/6.2]**. Domino scenarios where major accidents have an impact on more than one site are considered in the assessment of MA&D as described in **Section 22.8** and will also be thoroughly evaluated by the HSE during the COMAH notification process. When operational, the facility will form part of a COMAH domino group which will share safety information and coordinate emergency management arrangements.
	Local Resident (living within approx. 10km of the Project)	Concerns expressed about - the flammability of hydrogen; and - increased risk from hydrogen and ammonia storage.	This chapter contains an assessment of the potential risk events associated with the offloading and storage of ammonia and the production and storage of hydrogen. These risk events will be assessed in further detail within the safety studies described in **Section 22.8** and where risks cannot be eliminated, mitigation measures will reduce risks to a level demonstrated to be ALARP.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			These measures include a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management. Demonstration of ALARP is required by the applicable regulations including COMAH (Ref 22-3), Environmental Permitting (Ref 22-24), Hazardous Substances and Pipeline Safety Regulations (Ref 22-7). Engagement with regulatory bodies is ongoing, with the Hazardous Substances Consent application submitted and validated in March 2023 and pre-construction COMAH notification submitted on the 5 April 2023. Risk management, including risk assessment and consequence analysis, will be part of an ongoing process throughout the lifecycle of the facility.
	DFDS Seaways	Mitigation for the most vulnerable part of the Immingham Oil Terminal ("IOT") trunkway in the IERRT proposal suggested moving the most vulnerable part of the trunkway, the finger pier, to the eastern side of the main jetty. The IGET prohibits this as a mitigation option as it is in the same space. The IGET proposals consider that there are not likely to be significant cumulative effects in relation to the IERRT when considered together with the IGET for Major Accidents and Disasters and so provides no mitigation for what could be a potentially environmentally and commercially disastrous incident between a vessel and the IOT trunkway as it handles flammable, toxic and potentially polluting products which would affect all users of the port and could affect the operation of critical national infrastructure. This is a major safety concern and alternative mitigation needs to be provided in the IERRT DCO application that does not involve	In relation to the Immingham Eastern Ro-Ro Terminal ("IERRT") application, following a full assessment which included a number of Hazard Identification ("HAZID") Workshops and navigational simulations and the submission of a comprehensive navigational risk assessment, which has been considered by the Applicant's HAZBoard, it has been concluded that the relocation of the IOT finger pier is not required as part of the IERRT development. As a consequence, the IERRT DCO application does not include the relocation of the finger pier as a mitigation and the relocation is not part of the scope of that application. It follows, therefore, that as such the IGET proposal does not conflict with the IERRT DCO application in this regard.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		moving the finger pier, as the IGET proposal negates that option.	
		We remain extremely concerned that the safety risks, in particular around the IOT trunkway have been scoped out of assessment are not being considered in cumulative effect. Mitigation is needed to address the cumulative effect which the IGET will have with the IERRT and robust measures need to put in place before IGET can go ahead.	The cumulative effects of the Project with the proposed IERRT project have been assessed and are set out in **Chapter 25**: **Cumulative and In-Combination Effects** of the ES **[TR030003/APP/6.2]** and accompanying appendices. The cumulative effects assessment is also summarised in the **Non-Technical Summary** of the ES **[TR030008/APP/6.1]**.
	North East Lincolnshire Council	The environmental protection team acknowledges the proposal and anticipates the submission of the relevant environmental assessments. The construction phase also needs to be considered and detailed construction management measures put in place. We do note that a Hazardous Substance Consent has been submitted to the LPA and is currently going through validation. However, the LPA have reservations over the potential impact of the development and its associated HSE Zones with particular regard to human health, residential amenity and the effect such zones may have on future development. We look forward to working with the applicant to further understand this issue and the impacts of the development.	From a human health perspective, perception of risk has been considered in **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**. The health assessment also makes reference to the findings of the socio-economics assessment (**Chapter 23: Socio-Economics [TR030008/APP/6.2]**) which considers impacts on residential receptors. The Project has submitted a Hazardous Substances Consent application and COMAH notification and will work with the regulatory authorities via the consultation process to appropriately manage the impact of the development on all sensitive receptors. The impact of the land use planning zones (explained in **Section 22.3** below) on future development is addressed in **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.
	Polynt Composites UK Ltd	Finally, and straddling both the construction and operational phases of the IGET Project, we consider that the consultation information contains insufficient information of the assessment of the cumulative impacts of introducing another COMAH hazard to this location, particularly given the traffic and transport impacts referred to above. This is a key concern relative to the health and wellbeing of our	This assessment considers the implications of introducing a further COMAH facility to the area in terms of MA&D. The cumulative effects in respect of traffic and transport impacts are considered in **Chapter 11: Traffic and Transport [TR030008/APP/6.2].** An application for hazardous substance consent has been submitted to NELC by Air Products in connection with the

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		employees and the ongoing viability of our operation from the Plant.	hydrogen production facility which requires assessment of cumulative impacts of the Project with the surrounding land uses. Air Products is engaging with local stakeholders regarding emergency plan arrangements as required pursuant to the COMAH Regulations, including in connection with the COMAH Safety Report. Emergency Plans will be developed in compliance with the COMAH Regulations. Since the first statutory consultation, Air Products has had a number of discussions with Polynt, responded to their concerns by letter dated 20 July 2023 and will continue to engage with them.
	Associated Petroleum Terminals (Immingham) Ltd	**Impacts of the Proposal on the IOT** The IOT Operators are concerned about site safety issues relating to the construction, operation and decommissioning phases of the IGET Development. The IOT Operators have concerns relating to safety from the IGET Development including the risk of major fire, explosion or release of toxic gas. This could occur as a result of the following: a) Hydrogen leakage from the pipelines that cross the East Site; b) Ammonia leakage from the refrigerated ammonia storage tank on the East Site; c) Hydrogen and/or ammonia leakage from the hydrogen production units on the East Site; and d) Hydrogen leakage from the hydrogen liquefiers on the East Site The IOT Operators are concerned that both ammonia and, to a greater extent, hydrogen are both flammable substances and a leakage may cause a major fire or an explosion, which may affect the IOT site. In addition, the release of ammonia	The IOT Operator's concerns in relation to the Project are noted and discussions are ongoing between the Applicant, Air Products and the IOT Operators to address the IOT Operators' concerns. Over the last 6 months the Applicant and Air Products have held a number of meetings and site visits with IOT and independent consultants (DNV and BakerRisk). Detailed studies are ongoing as set out below, the results of which will be discussed and evaluated in conjunction with the IOT Operators. IOT representatives have participated in a number of technical workshop and meetings including the Navigational Simulations and the navigational HAZID workshop for the Project. IOT Operators' views as to what it considers to be the major accident hazard risks, arising out of the potential for hydrogen and ammonia leakage at the Project, are noted. IOT Operators acknowledge the Applicant's and Air Products' commitment to managing risk - those commitments are further described in this chapter (see **Section 22.9** of this chapter).

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		gas may have impacts on the IOT. These events have the potential to cause significant injuries and loss of life for those working at the IOT as well as causing major disruption to the activities of the IOT activities. The IOT Operators note the commitments in Chapter 22 of the PEI Report on Major Accidents and Disasters that the IGET Development will comply with all relevant safety and environmental legislation for the management of risks on industrial facilities from the construction phase until decommissioning. The chapter also notes that the risks associated with the IGET Development will be reduced by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to achieve a level of risk which is as low was reasonably practicable as required by the COMAH regulations. The IOT Operators welcome these commitments. However, the IOT Operators request that additional details are provided to demonstrate how the level of risk will be controlled through design and operational measures and management. The IOT Operators also believe that in addition to these obligations, other controls should be introduced to mitigate the risk of damage to IOT infrastructure and employees. This could include the provision of refuge buildings on the IOT site which would allow those working there to be safe from any major fire, explosion or release of toxic gas. Furthermore, the Applicant would like assurances that the infrastructure on the East Site is constructed, operated and ultimately decommissioned in a safe and suitable manner. This would minimise the risk of any major accident occurring	The IOT Operators request that additional details are provided to demonstrate how the level of risk will be controlled through design and operational measures and management. As the IOT Operators are aware the Control of Major Accident Hazard (COMAH) Regulations 2015 will apply to the hydrogen production facility, as an “upper tier” establishment (the IOT is also understood to be an upper tier establishment). The “competent authority” enforces the COMAH regime, being the HSE and the Environment Agency acting jointly. The detailed design and operation of the hydrogen production facility will be controlled appropriately through the application of the COMAH regime, including the requirement for the submission of safety reports before commencement of construction and operation. The analysis contained within those safety reports must demonstrate that risks have been reduced to as low as reasonably practicable (“ALARP”) and all measures necessary have been taken to prevent major accidents for the Project to proceed. In the context of the responsibilities of Air Products under the COMAH Regulations, the following studies are being undertaken to inform the detailed design of the Project for the purposes of the safety report: a) As indicated in **Section 22.7** and **Section 22.8** of this chapter, process safety studies by the independent consultants, commissioned by Air Products, to assess in detail the potential consequences of a loss of containment of hydrogen and ammonia from the facilities are ongoing. b) The process safety studies include consequence modelling, the output of which will show the distance a

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		which would impact the IOT. The IOT Operators consider that they should be provided with plans and method statements in advance of construction and decommissioning to ensure that safety measures are being complied with during construction and decommissioning and that adequate monitoring and maintenance will take place during operation. The IOT Operators should be given the opportunity to consider these documents and provide feedback along with providing reasonable requirements or conditions for approval. It is considered that these measures could be secured through protective provisions or requirements included in the DCO. Other impacts of the IGET Development on the IOT could also be mitigated through the protective provisions. The IOT Operators would welcome further discissions with ABP and Air Products to understand the impacts of the IGET Development on the IOT including how the risk of major accidents could be minimized to a level acceptable to the IOT Operators. The IOT Operators also require additional information to be provided on the concerns outlined above including what protective measures could be offered to mitigate the risk of a major accident taking place on the East Site.	release of ammonia could potentially extend to in the event of an accidental loss of containment. This will help inform decision making in respect of the detailed layout of the Project, including the location of emergency shelters and toxic refuges which are buildings in which people can safely take refuge in the event of an emergency such as a release of toxic gas and will include an assessment of impacts on the IOT facilities. c) Similarly, modelling will help define thermal radiation exposure levels and explosion overpressure levels which could be reached in the event of an incident involving a loss of containment of flammable material. This will inform the detailed location and design of facilities within the Project, particularly occupied buildings such as control rooms and will include an assessment of impacts on the IOT facilities. The output of these studies will be shared with key stakeholders, including the IOT Operators, and will be contained within the safety report submitted to the competent authority under the COMAH Regulations. The parties will also share information in the context of responsibilities under COMAH relating to domino effects. IOT Operators state that, in addition to the above controls regarding design and operational measures and management, further controls to mitigate the risk of damage to IOT infrastructure and employees should be introduced. The outcome of the above studies, discussion, evaluation and co-operation will enable the parties to assess potential impacts on the safety of IOT employees and associated infrastructure,

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			and consider appropriate ALARP measures under the COMAH Regulations. The IOT Operators seek assurances that infrastructure on the East Site will be constructed, operated and decommissioned in a safe and suitable manner in order to minimise the risk of a major accident occurring which would impact the IOT. In particular, the IOT Operators seek plans and method statements in advance of construction and decommissioning and the opportunity to provide feedback, along with providing reasonable requirements or conditions for approval. In terms of major accident hazards, the regime established by the COMAH Regulations provides an appropriate framework for ensuring the safe and suitable construction, operation and decommissioning of the East Site infrastructure, as regulated by the Environment Agency and HSE as competent authorities. The need for an environmental permit will require the application of 'Best Available Techniques'. Air Products are committed to continuing to engage with the IOT Operators during the detailed design process required by the COMAH regime in order to obtain feedback and understand their views. In terms of other impacts during construction and decommissioning, draft **outline Construction and Decommissioning Environmental Management Plans** (which form part of the DCO application **[TR030008/APP/6.5** and **TR030008/APP/6.6]**) have been prepared, with the objectives of managing these activities safely and minimising impacts. The final plans will be submitted to and approved by North East Lincolnshire Council, as the relevant local planning authority, under a requirement of the DCO. IOT Operators note that appropriate measures could be secured within the DCO documentation including through

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			requirements and protective provisions. ABP and Air Products are committed to ongoing engagement with IOT Operators to seek to address its concerns including assessment, alongside IOT, as to whether protective measures are appropriate or protective provisions required for IOT's existing infrastructure. IOT states that it would welcome further discussions with ABP and Air Products to understand the impacts of the Project on the IOT including how the risk of major accidents could be minimised to an acceptable level to IOT Operators. As outlined above, further discussions have taken place since receipt of the IOT Operators' representations and will continue. Air Products and ABP are committed to working closely with the IOT Operators to minimise risks of major accidents in accordance with their statutory requirements.
		Assessed Need for the Scheme The IOT Operators recognize that the National Policy Statement for Ports contains a presumption in favour of granting consent to applications for ports development. Owever, that presumption is subject to the more specific policies contained within the NPS. Section 4.17 of the NPS states, amongst other things, that there may be national security considerations where development consent relates to potentially critical infrastructure. The IOT comprises nationally critical infrastructure and should be given due regard when the application for the IGET Development is considered. To be clear, the IOT Operators are not suggesting that the IGET Development is, as a matter of principle, incompatible with the IOT such that national security could be compromised. However, the IOT Operators consider that the status of the	The **Planning Statement [TR030008/APP/7.1]** submitted with the DCO application contained a detailed analysis of the Project against the policies in the National Policy Statement for Ports ("NPSfP") and includes consideration of paragraph 4.17 of that policy on national security. The acknowledgement from APT that there is no suggestion that the Project is, as a matter of principle, incompatible with the IOT such that national security should be compromised is welcomed. As noted above, the status of the IOT facility is recognized and discussions are ongoing between the Applicant, Air Products and the IOT Operators to seek to minimize the impact of the Project on the IOT operations.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		IOT means that ABP should give significant consideration in the design of the IGET Development to the potential impacts to the IOT and should be able to demonstrate that they have done so at a future examination of the DCO. The IOT Operators expect ABP to have taken active steps to mitigate against any risks and impacts to the IOT.	
		Conclusion For the reasons outlined in this consultation response, the IOT Operators have substantial concerns about certain safety aspects of ABP's proposals. The IOT Operators are particularly concerned about the potential risk of major accidents occurring at the proposed East Site of the IGET Development. This could cause injuries and loss of life for those working at the IOT and cause major disruption to the activities of the IOT Operators. In order to fully understand these concerns, the IOT Operators have requested further information from ABP about various aspects of the proposals and have asked for certain plans and documents to be shared or prepared jointly between ABP and the IOT Operators at the earliest opportunity, to inform the assessment or risk presented by the IGET Development. As the initial tenants of the East Site, it is envisaged that Air Products would also form a key part of these discussions. Subject to further discussions and the provision of information requested above by the IOT Operators, it is also expected that any or all of the following measures may be required to be included in ABP's future application for development consent:	The summary of APT's concerns is noted and understood. The Project team looks forward to continued discussions with the IOT Operators with a view to minimizing the impact of the Project on their operations and to the continued sharing of information between the parties.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		a) Protective provisions for the benefit of the IOT Operators' existing infrastructure during the construction of the ABP proposals; and / or b) Requirements controlling the manner in which the ABP proposals are constructed, operated and decommissioned for the protection of the IOT and the IOT Operators' equipment installed on it.	
Second Statutory Consultation May 2023 – July 2023	Local resident (living within approx. 10km of the Project)	Objection to the project noted on basis that western edge of project is too close to residential areas, which could result in a major incident due to the materials stored and processed on site, as well as on neighbouring sites in and around the port.	The Project has submitted a Hazardous Substances Consent application and COMAH notification and will work with the regulatory authorities via the consultation process to appropriately manage the impact of the development on all sensitive receptors. The impact of the land use planning zones (explained in **Section 22.3** below) on future development is addressed in **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.
	Associated Petroleum Terminals (Immingham) Ltd	**Impacts of the Proposal on the IOT** The IOT Operators are concerned about site safety issues relating to the construction, operation and decommissioning phases of the IGET Development. The IOT Operators have concerns relating to safety from the IGET Development including the risk of major fire, explosion or release of toxic gas. This could occur as a result of the following: a) Hydrogen leakage from the pipelines that cross the East Site; b) Ammonia leakage from the refrigerated ammonia storage tank on the East Site; c) Hydrogen and/or ammonia leakage from the hydrogen production units on the East Site; and	The Applicant and Air Products note that APT also replied to the second Statutory Consultation resubmitting the earlier consultation response. APT's comments are addressed in the response to the first Statutory Consultation set out above.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		d) Hydrogen leakage from the hydrogen liquefiers on the East Site The IOT Operators are concerned that both ammonia and, to a greater extent, hydrogen are both flammable substances and a leakage may cause a major fire or an explosion, which may affect the IOT site. In addition, the release of ammonia gas may have impacts on the IOT. These events have the potential to cause significant injuries and loss of life for those working at the IOT as well as causing major disruption to the activities of the IOT activities. The IOT Operators note the commitments in Chapter 22 of the PEI Report on Major Accidents and Disasters that the IGET Development will comply with all relevant safety and environmental legislation for the management of risks on industrial facilities from the construction phase until decommissioning. The chapter also notes that the risks associated with the IGET Development will be reduced by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to achieve a level of risk which is as low was reasonably practicable as required by the COMAH regulations. The IOT Operators welcome these commitments. However, the IOT Operators request that additional details are provided to demonstrate how the level of risk will be controlled through design and operational measures and management. The IOT Operators also believe that in addition to these obligations, other controls should be introduced to mitigate the risk of damage to IOT infrastructure and employees. This could include the provision of refuge buildings on the IOT site which would	

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		allow those working there to be safe from any major fire, explosion or release of toxic gas. Furthermore, the Applicant would like assurances that the infrastructure on the East Site is constructed, operated and ultimately decommissioned in a safe and suitable manner. This would minimise the risk of any major accident occurring which would impact the IOT. The IOT Operators consider that they should be provided with plans and method statements in advance of construction and decommissioning to ensure that safety measures are being complied with during construction and decommissioning and that adequate monitoring and maintenance will take place during operation. The IOT Operators should be given the opportunity to consider these documents and provide feedback along with providing reasonable requirements or conditions for approval. It is considered that these measures could be secured through protective provisions or requirements included in the DCO. Other impacts of the IGET Development on the IOT could also be mitigated through the protective provisions. The IOT Operators would welcome further discissions with ABP and Air Products to understand the impacts of the IGET Development on the IOT including how the risk of major accidents could be minimized to a level acceptable to the IOT Operators. The IOT Operators also require additional information to be provided on the concerns outlined above including what protective measures could be offered to mitigate the risk of a major accident taking place on the East Site. **Assessed Need for the Scheme**	

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		The IOT Operators recognize that the National Policy Statement for Ports contains a presumption in favour of granting consent to applications for ports development. Owever, that presumption is subject to the more specific policies contained within the NPS. Section 4.17 of the NPS states, amongst other things, that there may be national security considerations where development consent relates to potentially critical infrastructure. The IOT comprises nationally critical infrastructure and should be given due regard when the application for the IGET Development is considered. To be clear, the IOT Operators are not suggesting that the IGET Development is, as a matter of principle, incompatible with the IOT such that national security could be compromised. However, the IOT Operators consider that the status of the IOT means that ABP should give significant consideration in the design of the IGET Development to the potential impacts to the IOT and should be able to demonstrate that they have done so at a future examination of the DCO. The IOT Operators expect ABP to have taken active steps to mitigate against any risks and impacts to the IOT. **Conclusion** For the reasons outlined in this consultation response, the IOT Operators have substantial concerns about certain safety aspects of ABP's proposals. The IOT Operators are particularly concerned about the potential risk of major accidents occurring at the proposed East Site of the IGET Development. This could cause injuries and loss of life for those working at the IOT and cause major disruption to the activities of the IOT Operators.	

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		In order to fully understand these concerns, the IOT Operators have requested further information from ABP about various aspects of the proposals and have asked for certain plans and documents to be shared or prepared jointly between ABP and the IOT Operators at the earliest opportunity, to inform the assessment or risk presented by the IGET Development. As the initial tenants of the East Site, it is envisaged that Air Products would also form a key part of these discussions. Subject to further discussions and the provision of information requested above by the IOT Operators, it is also expected that any or all of the following measures may be required to be included in ABP's future application for development consent: c) Protective provisions for the benefit of the IOT Operators' existing infrastructure during the construction of the ABP proposals; and / or Requirements controlling the manner in which the ABP proposals are constructed, operated and decommissioned for the protection of the IOT and the IOT Operators' equipment installed on it.	
	DFDS Seaways	**Navigational Safety – the finger pier** Mitigation for the most vulnerable part of the Immingham Oil Terminal ("IOT") trunkway in the IERRT proposal suggested moving the most vulnerable part of the trunkway, the finger pier, to the eastern side of the main jetty. The IGET prohibits this as a mitigation option as it is in the same space. The IGET proposals consider that there are not likely to be significant cumulative effects in relation to the IERRT when considered together with the IGET for Major Accidents and	In relation to the Immingham Eastern Ro-Ro Terminal ("IERRT") application, following a full assessment which included a number of Hazard Identification ("HAZID") Workshops and navigational simulations and the submission of a comprehensive navigational risk assessment, which has been considered by the Applicant's HAZBoard, it has been concluded that the relocation of the IOT finger pier is not required as part of the IERRT development. As a consequence, the IERRT DCO application does not include

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		Disasters and so provides no mitigation for what could be a potentially environmentally and commercially disastrous incident between a vessel and the IOT trunkway as it handles flammable, toxic and potentially polluting products which would affect all users of the port and could affect the operation of critical national infrastructure. This is a major safety concern and alternative mitigation needs to be provided in the IERRT DCO application that does not involve moving the finger pier, as the IGET proposal negates that option.	the relocation of the finger pier as a mitigation and the relocation is not part of the scope of that application. It follows, therefore, that as such the IGET proposal does not conflict with the IERRT DCO application in this regard.
		Conclusion We remain extremely concerned that the safety risks, in particular around the IOT trunkway have been scoped out of assessment are not being considered in cumulative effect. Mitigation is needed to address the cumulative effect which the IGET will have with the IERRT and robust measures need to put in place before IGET can go ahead.	The cumulative effects of the Project with the proposed IERRT project have been assessed and are set out in **Chapter 25**: **Cumulative and In-Combination Effects** of the ES **[TR030003/APP/6.2]** and accompanying appendices. The cumulative effects assessment is also summarised in the **Non-Technical Summary** of the ES **[TR030008/APP/6.1]**.

22.3 Legislation, Policy and Guidance

22.3.1 **Table 22-2** presents the key legislation, policy and best practice which applies to the facilities included within the Project in the context of MA&D. The duty holder under the HSWA for these facilities may include operators other than the Applicant.

22.3.2 There are a considerable number of best practice guidance documents and engineering design standards applicable to the assessment of MA&D for the Project.

Table 22-2: Relevant Legislation, Policy and Best Practice Regarding MA&D

Legislation/Policy/Guidance	Consideration within the chapter
National Policy Statement for Ports ("NPSfP") (Ref 22-43)	
The National Policy Statement for Ports ("NPSfP") (Ref 22-43) contains a number of assessment principles concerning good design for infrastructure and pollution control that have relevance to the topic of MA&D. Although the NSPfP (Ref 22-43) does not make specific mention of MA&D, it does acknowledge the importance of early engagement with the HSE in relation to hazardous substances and the role that the planning system has in protecting and improving public safety.	The assessment principles of relevance to the topic of MA&D have been taken into account within the assessment. The HSE has been engaged as part of pre-application discussions, the outcomes of which have been considered as part of the assessment and discussions are ongoing between Air Products and the HSE.
National Planning Policy Framework ("NPPF") (Ref 22-44)	
The National Planning Policy Framework ("NPPF") (Ref 22-44) contains policies relating to the vulnerability to flooding of installations requiring hazardous substances consent. It also acknowledges that decision-making should promote public safety by anticipating malicious threats and natural hazards.	Relevant policies concerning hazards and safety have been reviewed and taken into account within the assessment. Through the consideration of alternative layouts, designs and technological solutions, the design-development process has sought to minimise risks to Project infrastructure from natural hazards, and risks from the Project on receptors.
National Planning Practice Guidance ("NPPG")	
National Planning Practice Guidance ("NPPG") supports the NPPF (Ref 22-44) by providing topic-specific guidance on national policy matters.	The following PPGs are relevant to MA&D and have been considered as part of the assessment process: Hazardous substances (Ref 22-45). Flood risk and coastal change (Ref 22-46). Climate change (Ref 22-47).

Legislation/Policy/Guidance	Consideration within the chapter
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 22-4)	
The Infrastructure Planning (EIA) Regulations 2017 require that the effects of a project, where these are likely to have a significant effect on the environment, are taken into account in the decision-making process for that project. These regulations indicate the process and requirements for the provision of adequate environmental information to enable the EIA process. Regulation 5 - Environmental Impact Assessment ("EIA") process Paragraph 4 The effects to be identified, described and assessed under paragraph (2) include, where relevant, the expected significant effects arising from the vulnerability of the proposed development to major accidents or disasters that are relevant to that development.	This chapter contains a description of the potential types of risk events identified as being relevant to the Project which could result in a MA&D. The IEMA guidance (Ref 22-2) defines a risk event as an identified, unplanned event, which is considered relevant to the development and has the potential to result in a major accident and/or disaster, subject to assessment of its potential to result in a significant adverse effect on an environmental receptor. A significant effect is defined as one which could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration. The nature of the Project is such that there are a number of potential risk events as a result of the substances present on Site, however, the Project is required to demonstrate to the regulatory authorities that risks have been reduced to levels that are ALARP prior to the start of operational activities. This chapter therefore presents the assessment to identify risk events, categorise their significance and summarise the control and mitigation measures to reduce risk, for the purposes of the EIA process.
The Control of Major Accident Hazards Regulations 2015 (Ref 22-3)	
The COMAH Regulations 2015 (as amended) implement the Seveso III Directive and are applicable to the operators of establishments which store quantities of dangerous substances equal to or in excess of the qualifying quantities listed in Schedule 1 of the Regulations. The COMAH Regulations require that operators take all necessary measures to prevent major accidents involving dangerous substances and are enforced by the Competent Authority comprising HSE and Environment Agency ("EA") acting in cooperation. Part 2 General Duties of Operators The inventory of substances at the Project would be in excess of the qualifying quantities listed in Schedule 1 of the	This ES contains a high-level identification of credible MA&D which will be considered as part of the ongoing programme of work to be carried out by the operator (the person in control of operations at the COMAH establishment) to demonstrate that risks associated with the Project are reduced to a level ALARP, as required by the COMAH Regulations. (Control of Major Accident Hazards)

Legislation/Policy/Guidance	Consideration within the chapter
COMAH Regulations, therefore this legislation is applicable to the Project. Regulation 5(1) Every operator must take all measures necessary to prevent major accidents and to limit their consequences for human health and the environment. Notifications Regulation 6(1) Within a reasonable period of time prior to the start of construction of a new establishment the operator must send to the competent authority a notification containing the information set out in Regulation 6. Regulation 6(2) Within a reasonable period of time prior to the start of operation of a new establishment the operator mut send to the competent authority a notification containing the information set out in Regulation 6. Major Accident Prevention Policy and Safety Management System Regulation 7(1) Every operator must prepare and retain a written Major Accident Prevention Policy (MAPP). Regulation 7(3) A MAPP must be prepared by the operator of a new establishment within a reasonable period of time prior to construction or operation of the establishment. Regulation 7(7) An operator must implement its MAPP by a safety management system (SMS). COMAH Safety Report Regulation 8 Every operator of an Upper Tier COMAH establishment must prepare a COMAH Safety Report, containing the information set out in Regulation 8. Regulation 9(2) An operator must send a safety report to the Competent Authority within a reasonable period of time prior to the start of construction of the establishment and prior to the start of operation of the establishment. Regulation 12(1) Every operator of a Upper Tier establishment must prepare an internal emergency plan, specifying the measures to be taken inside the establishment.	

Legislation/Policy/Guidance	Consideration within the chapter
Land Use Planning Public Safety Advice (HSE) (Ref 22-25)	
The HSE is a statutory consultee for planning applications around major hazard sites and pipelines and on applications for hazardous substances consent. HSE's advice is aimed at mitigating the effects of a major accident on the population around a major hazard site The HSE is a statutory consultee for developments which are subject to COMAH Regulations, such as this Project. Part of the consultation process will involve a review by the HSE of the site location relative to existing installations (includes COMAH sites, major accident hazard pipelines). These existing installations will have defined consultation zones. The HSE's consultation zones (often referred to as land use planning zones) are categorised as either 'Inner', 'Middle' or 'Outer' and a separate category is applied for the safeguarding zones associated with explosive hazards. Within these zones, the HSE's decision making criteria are based on the type of development which is proposed within the zone, the vulnerability of those likely to be present within those developments and the societal tolerance of the associated risk. HSE's advice will usually depend upon: • The consultation zone within which the proposed development is located - the Inner Zone is closest to the major hazard where risks and hazards are greatest and restrictions on development are strictest, followed by the Middle Zone and the Outer Zone. The zones are normally determined by a detailed assessment of the risks and/or hazards of the installation which takes into account the quantity of hazardous substances for which hazardous substances consent is held and the details of storage and/or processing, the hazard range and consequences of major accidents involving the hazardous substances that could be present. • The "sensitivity level" of the proposed development derived from HSE's	The information contained within this chapter will form part of the information and assessments undertaken by Air Products to be considered by the HSE during the statutory consultation process on the HSC application and the COMAH notification. Information about this Project will be considered by the HSE alongside the existing consultation zones associated with existing installations within the area. The outcome from the consultation will inform the ongoing development of the Project. Further information about the application of land use planning zones to the Project is set out in **Section 22.3.**

Legislation/Policy/Guidance	Consideration within the chapter
categorisation of development types. There are 4 broad sensitivity levels: level 1 – based on the normal working population; level 2 – based on the general public at home and involved in normal activities; level 3 – based on vulnerable members of the public; and level 4 – large examples of level 3 and very large outdoor developments. Other rules may apply in more complex cases, for example where the project is located in more than one zone or there is more than one hazard or development type.	
The Environmental Permitting (England and Wales) Regulations ("EPR") 2016 Regulations (Ref 22-24)	
Installations which carry out one or more defined prescribed activities such as chemical manufacturing are subject to the Environmental Permitting Regulations (EPR). EPR requires operators to supply detailed information to the Regulator in the form of a Permit Application and only once the Permit is issued is operation allowed to commence. Operators of sites regulated by EPR are required to take the measures set out in the Permit to prevent incidents and accidents.	The chapter includes the identification of MA&D with environmental impacts which is also part of the requirements of the ERP regulation. This information is summarized in **Table 22-3** and **Table 22-4**.
The Planning (Hazardous Substances) Regulations 2015 (Ref 22-7)	
The Planning (Hazardous Substances) Regulations 2015 apply to facilities which would like to hold quantities of hazardous substances at or above defined limits within the Regulations. These facilities must obtain a Hazardous Substance Consent ("HSC"). Applications for HSC are made to the hazardous substance authority (usually the local planning authority and in this case, is North East Lincolnshire Council ("NELC")). The HSE is a statutory consultee for HSC applications. These Regulations amend planning procedures in relation to sites where hazardous substances are held and to land near those sites through the creation of land use planning zones as explained above.	The information required in connection with a HSC application and listed in Regulation 5(1)(d)(i) to (vi) is contained within **Chapter 2: The Project [TR030008/APP/6.2]**. The information required by Regulation 5(1)(d)(vii) and (viii) is included in this chapter, specifically **Figure 22.1 [TR030008/APP/6.3]** and **Section 22.7** respectively. The inventory of substances stored within the landside infrastructure areas of the Project would be in excess of the qualifying quantities listed in Schedule 1 of the Hazardous Substances Regulations, and therefore this legislation is applicable. An application for HSC has been submitted to NELC and validated. The assessment in this chapter considers the information included within the application for HSC to the Local Planning Authority.

Legislation/Policy/Guidance	Consideration within the chapter
This consent process regulates the storage and use of hazardous substances and enables breaches of control, which may present serious risks, to be dealt with quickly and effectively. However, even after measures have been taken to prevent major accidents, there will remain a residual risk of an accident which cannot entirely be eliminated. The need for HSC ensures that this residual risk to people in the vicinity or to the environment is taken into account before a hazardous substance is allowed to be present in a controlled quantity. The extent of this risk will depend upon where and how a hazardous substance is present, and the nature of existing and prospective uses of the application site and its surroundings. Part 3 Hazardous Substances Consent Procedures Regulation 5(1) Subject to paragraph (2) and regulation 23 (application of the Act to hazardous substances authorities), an application for hazardous substances consent must: (d) include details of: (i) the location of the land to which the application relates; (ii) the person in control of the land to which the application relates; (iii) each hazardous substance for which consent is sought (“relevant substance”), including the maximum quantity of each relevant substance proposed to be present; (iv) the main activities carried out or proposed to be carried out on the land to which the application relates; (v) how and where each relevant substance is to be kept and used; (vi) how each relevant substance is proposed to be transported to and from the land to which the application relates; (vii) the vicinity of the land to which the application relates, where such details are relevant to the risks or consequences of a major accident; and	

Legislation/Policy/Guidance	Consideration within the chapter
(viii) the measures taken or proposed to be taken to limit the consequences of a major accident.	
Health and Safety at Work etc. Act 1974 ("HSWA") and Regulations made thereunder (Ref 22-1)	
The HSWA is the primary legislative instrument covering workplace health and safety in Great Britain. It sets out the general duties which employers have towards employees, and which employees have to themselves and each other. The HSWA establishes the obligations to ensure, so far as is reasonably practicable (SFAIRP), that persons are not exposed to risks to their health and safety. The HSE, along with local authorities, are responsible for enforcing the HSWA. Preliminary – Article 1 The provisions of this Part shall have effect with a view to— (a) Securing the health, safety and welfare of persons at work. (b) Protecting persons other than persons at work against risks to health or safety arising out of or in connection with the activities of persons at work. (c) Controlling the keeping and use of explosive or highly flammable or otherwise dangerous substances, and generally preventing the unlawful acquisition, possession and use of such substances.	This chapter contains a high level description of the mitigation measures proposed to manage the reasonably foreseeable identified risks to health and safety of persons working at the Site, in neighbouring facilities and other persons which may be affected by these operations. The mitigation measures described in this chapter include the primary containment systems for dangerous substances, such as hydrogen and ammonia, and the security systems to prevent unauthorised access to operational areas where they are present.
The Pipelines Safety Regulations 1996 ("PSR") (Ref 22-6)	
The PSR, made under the HSWA, do not cover the environmental aspects of accidents arising from pipelines. However, the Regulations, by ensuring that a pipeline is designed, constructed and operated safely, provide a means of securing pipeline integrity, thereby reducing risks to the environment. It is important that effects on the environment are considered at all stages in the life cycle of a pipeline.	This Project would include installation of pipelines connecting the two operational process areas and the jetty, crossing land which is not owned and under the control of the Applicant and therefore the PSR will apply. These pipelines would transport hydrogen and ammonia, consequently, these are categorised as MAH pipelines within the PSR. A further pipeline would transport nitrogen between the East and West Sites. Gaseous nitrogen is not classified as a dangerous fluid in accordance with regulation 18(2)

Legislation/Policy/Guidance	Consideration within the chapter
The PSR require operators of major accident hazard ("MAH") pipelines to ensure that they are designed (and subsequently modified if necessary) so that they are safe to operate within the range of operating conditions to which they will be subjected. Safety systems such as emergency isolation and pressure relief valves will be provided to secure safe operation. Specific emergency plans are required for the pipelines and a Major Accident Prevention Document ("MAPD") is to be produced, describing the hazards and safety management systems associated with management of risk. Operators are required to notify the HSE in advance of construction of a MAH pipeline and operations commencing.	and Schedule 2 of the PSR, therefore this pipeline is not categorised as a MAH pipeline. This chapter establishes the principles to be adopted by the Project to ensure compliance with these Regulations, including identification and management of the risks associated with their operation.
Construction (Design and Management) 2015 Regulations ("CDM") (Ref 22-8)	
The CDM Regulations place specific duties on those undertaking defined roles during construction activities, such as clients, designers and contractors. These duties are to ensure health and safety is managed throughout the life of a construction project.	This chapter includes certain general overarching principles of how the Project will comply with CDM, to manage risks which have the potential to be a major accident, such as the development of a Construction Environmental Management Plan ("CEMP").
The Dangerous Substances and Explosive Atmospheres Regulations 2002 ("DSEAR") (Ref 22-9)	
DSEAR set out the minimum requirements for the protection of workers from fire and explosion risks related to dangerous substances and potentially explosive atmospheres. These Regulations apply to employers at workplaces in Great Britain where a dangerous substance such as hydrogen is present or could be present. For COMAH Installations, DSEAR is enforced by the HSE. Compliance with DSEAR requires employers to assess and control risks and ensure safety measures are in place before beginning work activities. Areas where an explosive atmosphere may be present must be identified, and can include tank vents, around flanged connections in pipework and many others.	The presence of substances such as hydrogen, ammonia and natural gas – categorised in these Regulations as dangerous – render the DSEAR applicable. Mitigation measures to reduce the risk of MA&D events such as fire, explosion and toxic gas release include activities carried out for the purposes of DSEAR compliance. These activities would be undertaken throughout the lifecycle of the Project, from an early stage in the engineering design process where explosive atmospheres would be identified, and equipment (mechanical and electrical) would be specified appropriately. DSEAR compliance during construction includes assessments for the safe use of diesel which is classified as a flammable fluid within mobile plant. During Project operation and maintenance activities, detailed risk assessments would be completed,

Legislation/Policy/Guidance	Consideration within the chapter
New equipment supplied for use in places where an explosive atmosphere may occur must meet the requirements established by DSEAR to prevent a source of ignition becoming active and available, thus increasing the risk of fire and/ or explosion.	documented and regularly updated to reflect any changes made on site. These risk assessments would demonstrate a robust basis for safe operation of the Site as required by DSEAR.
The Chemical and Downstream Oil Industries Forum Guideline on Environmental Risk Tolerability for COMAH Establishments ("CDOIF") (Ref 22-10)	
The COMAH Competent Authority recognizes the CDOIF Guideline on Risk Tolerability at COMAH Establishments as providing an appropriate methodology to Operators completing their COMAH Safety Reports. These reports must include an assessment of the environmental consequences (extent, severity and duration) of potential accidents, to determine whether the effects might constitute a Major Accident to the Environment ("MATTE"). The CDOIF guideline methodology includes a structured approach to assessing environmental risks following major accidents, taking into consideration the extent (the area / distance), the severity (the degree of harm within the area of impact), and duration (the recovery period) of the event. The levels of harm to the environment which would be categorised as serious depends on the type of receptor, therefore this methodology includes threshold harm levels specific to categories of receptor e.g., groundwater and soils. Risk is evaluated taking into consideration the severity and duration of the event, and a category of MATTE can be concluded. These risk categories are A (lowest) to D (highest). Risks identified as being below category A are termed 'sub-MATTE' and can be screened out of further assessment. For each MATTE event identified, the CDOIF guidance presents frequency limits to identify events which can be categorised as 'intolerable' or 'broadly acceptable'. Where risks are classed as intolerable, Operators must take additional measures to reduce risk.	Operators of COMAH sites such as the Project recognise the CDOIF methodology as providing best practice for environmental risk assessment ("ERA"). An ERA is typically undertaken following or alongside the engineering design process prior to operation, to support the development of the COMAH Safety Report. However, this methodology is focused on oil and chemicals/hazardous liquids and not industrial gases processes and was not developed in consultation with the industrial gases industry, so will need be used with caution in this context. The measures to prevent and mitigate the consequences of MA&D include undertaking an ERA to support COMAH compliance and demonstrate that all measures necessary have been taken to prevent major accident hazards. The output of the ERA provides guidance to operators on the suitability of their installed systems such as bunding and containment, to prevent an accidental release reaching the environment. Consequently, a robust ERA employing the CDOIF methodology is listed as a mitigation measure in **Section 22.7**.

Legislation/Policy/Guidance	Consideration within the chapter
British Standard ("BS") 61508 (Ref 22-11) **/ 61511** (Ref 22-12) **Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems**	
Functional safety is a term used to describe engineering assessments and systems to reduce the risk to people and the environment from process operations via the use of automatic protection functions. COMAH Installations typically employ functional safety within Safety Instrumented Systems ("SIS"), which provide control functions for process operations. SIS incorporate devices such as automatic high pressure and low pressure trips, the purpose of which is to return a process operation to a safe condition if a deviation occurs, without the need to an operator in a control room to take action. SIS incorporate computer controlled functions to monitor process conditions and are connected to devices such as valves, which open or close automatically in response to a computer signal. The reliability of SIS is important to the safe operation of the Project's process facilities. The means of demonstrating an appropriate level of reliability can be achieved is established in a series of standards developed by the International Electrotechnical Commission ("IEC") and published by the British Standards Institution ("BS"). BS 61508 is a basic functional safety standard applicable to all industries and BS 61511 is specific guidance for the process industries as well as implementing Safety Instrumented Functions and safety lifecycle process in accordance with IEC61511. These guidance documents are recognised by the Competent Authority as representing best practice for functional safety.	Operators of COMAH sites such as the Project recognise these standards as providing best practice in the engineering design of process facilities and the specification of SIS Safety Instrumented Functions and safety lifecycle process in accordance with IEC 61511, which are important to prevent a loss of containment occurring from process systems which could lead to an accident. These standards are a key mitigation measure in the prevention of a number of risk events, such as fire, explosion and toxic release which are noted in **Section 22.7**.
IMDG International Maritime Dangerous Shipping Code (Ref 22-13)	
"IMDG" Code or International Maritime Dangerous Goods Code is accepted by the MSC (Maritime Safety Committee) as an international guideline to the safe transportation or shipment of dangerous goods or hazardous materials by water on	The control of transfer of dangerous goods from shipping vessels will be undertaken in liaison with the Port Authority, Shipping Agent, Ship Owner and Operator under the development of suitable procedures and operational checklists (ship-to-shore).

Legislation/Policy/Guidance	Consideration within the chapter
vessel. The liaison between operators and vessels transferring (ship to shore) dangerous goods transfer requires compliance with IMDG Code and all personnel who play a role in the maritime shipping or receiving of dangerous goods are required to comply with the IMDG Code. Section 1.3 of this code explains that IMDG shipping training is mandated for all shipping and receiving employees who handle dangerous goods.	Consultation with stakeholders including the Port operator has been carried out during a navigational hazard review workshop. The results of the NRA are described in detail in **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**. Prior to operation, an ERA would be produced for the Project which will use best practice such as the CDOIF methodology described in **Table 22-2**. This assessment would determine the sufficiency of protection measures in the event of a scenario such as a release to the marine environment and conclude if risks are within the tolerable category. Further mitigation measures are listed in **Table 22-6.**

22.3.3 **Table 22-3** presents the key legislation which applies to the facilities included within the Project of relevance to MA&D. The duty holder for these facilities may include operators other than the Applicant (including Air Products in respect of the hydrogen production facility). N/A denotes the legislation is not applicable.

Table 22-3: Applicability of Legislation to Project Facilities and Areas

Project Facility/ Area	COMAH Regulations	Hazardous Substances Consent	Pipelines Safety Regulations
Ships in Transit	N/A	N/A	N/A
Ships in Port	Applicable	N/A	N/A
Pipelines on Jetty Trestle	Applicable	N/A	Applicable
Terrestrial Pipelines (Connecting Process Facilities to Jetty)	Applicable	N/A	Applicable
Process Facilities (inc. Hydrogen and Ammonia Storage)	Applicable	Applicable	N/A

22.3.4 A key aspect of the COMAH Regulations and Hazardous Substances Consent Regulations is the consideration of the compatibility of certain types of new development, such as the Project, with other land uses, in order to maintain adequate separation from residential areas, buildings and areas of public use around major hazards where the development increases the risk or consequences of a major accident. Any new development should not significantly worsen the situation should a major accident occur. The HSE is a statutory consultee during the planning and HSC process and is responsible for advising whether the risks associated with a new development such as the Project are at

an acceptable level. This decision making process includes the use of criteria referred to as 'Consultation Distances' which are zones (referred to above as land use planning zones) established by the HSE around major accident hazard sites and pipelines for planning control.

22.3.5 The HSE's Consultation zones are categorised as either 'Inner', 'Middle' or 'Outer' and a separate category is applied for the safeguarding zones associated with explosive hazards. Within these zones, the HSE's decision making criteria are based on the type of development which is proposed within the zone, the vulnerability of those likely to be present and the societal tolerance of the associated risk. The Inner Zone is closest to the major hazard where risks and hazards are greatest and restrictions on development are strictest. A full description of these zones is found at HSE: Land Use Planning (Ref 22-25). The operator will still need to ensure that the overall risk of a major accident is reduced to ALARP in accordance with the COMAH Regulations (Ref 22-3).

22.3.6 The methodology used by HSE when providing land use planning advice is based on the following principles:

a. The risk considered is the residual risk which remains after all reasonably practicable preventative measures have been taken to ensure compliance with the requirements of the Health and Safety at Work etc. Act 1974 and its relevant statutory provisions.

b. Where it is beneficial to do so, advice takes account of risk as well as hazard, that is the likelihood of an accident as well as its consequences.

c. Account is taken of the size and nature of the proposed development, the inherent vulnerability of the exposed population and the ease of evacuation or other emergency procedures for the type of development proposed. Some categories of development (e.g. schools and hospitals) are regarded as more sensitive than others (e.g. light industrial), and advice is weighed accordingly.

d. Consideration is given to the risk of serious injury, including that of fatality, attaching weight to the risk where a proposed development might result in a large number of casualties in the event of an accident.

22.3.7 The Project is within the consultation distances of a number of major hazard sites and pipelines; this is a key factor which has been taken into account during the Project design and planning. As noted above, an application for HSC has been submitted to NELC in connection with the hydrogen production facility.

22.3.8 The land use planning zones are expected to impact the residential properties located on the west side of Queens Road, which are included within the Site boundary. This is based on a study commissioned by Air Products and completed by DNV which estimated the planning zones based on an assessment methodology which in DNV's experience reflects that used by HSE (HSE does not publish its methodology). This study informed the design process such that the proposed work area locations and what is proposed in each one take into account the sources of major accident hazards to reduce as far as possible the potential land use planning zones. On the basis of this work, once the hydrogen production facility on the West Site is fully operational, it is expected that these

properties will fall within or close to the Inner Zone associated with the operational Project.

22.3.9 The continued residential use of those properties is therefore considered incompatible with the operation of the hydrogen production facility on the West Site and will need to cease. Discussions are ongoing with the owners and occupiers with a view to negotiating the acquisition of the properties by agreement. Where it is not possible to acquire the properties through negotiation, compulsory acquisition powers will be sought through the DCO.

22.3.10 As explained in **Chapter 2: The Project [TR030008/APP/6.2]**, a number of businesses are also present in the same area on the west side of Queens Road. It is considered that the ongoing operation of those businesses will be compatible with the operation of the hydrogen production facility, based on the DNV study referenced in **paragraph 22.3.8** above.

22.4 Assessment Methodology

Overview

22.4.1 There is no set approach for this type of assessment contained within the EIA Regulations (Ref 22-4); however, guidance is available from sources such as IEMA (Ref 22-2) which this assessment is consistent with.

22.4.2 The methodology used in this chapter to identify credible major accidents relevant to the Project is based on an assessment of the properties of dangerous substances which could be present during the lifecycle of the Project, and the activities and operations involving these substances, from construction and operation to decommissioning and demolition.

22.4.3 The geographical location of the Project is also considered, to identify additional major accident scenarios and credible potential disaster scenarios. The Project location establishes the susceptibility of the Site to impacts such as climatic and seismic events and the vulnerability of receptors.

22.4.4 The location of the Site relative to industrial neighbours such as bulk fuel storage and chemical manufacturing facilities, can increase the risk to receptors from incidents which are referred to within the COMAH Regulations (Ref 22-3) as ‘domino effects’. An example of such an event is a fire occurring at a COMAH facility which initiates an incident at a neighbouring COMAH facility. This category of scenario can include events at the Site which can have an effect at a nearby industrial facilities and also events which are initiated at a nearby industrial facility which can reach the Site. The assessment of MA&D considers the potential for these events to occur and describes the approach to prevention and mitigation of the risks associated with domino effects.

22.4.5 The criteria to define the level of harm to people and the environment which would constitute a MA&D is not defined within the EIA Regulations (Ref 22-4). This assessment therefore uses the criteria for notification of a major accident hazard as established in the COMAH Regulations (Ref 22-3).

22.4.6 The COMAH Regulations (Ref 22-3) apply to sites in which quantities of hazardous materials are or could be present above defined thresholds. The substances stored in operational areas of the Project are expected to be present above the threshold quantities established in Annex 1 of the COMAH Regulations (Ref 22-3), and consequently this approach is considered reasonable for the assessment of MA&D carried out for this Project.

22.4.7 Schedule 5 of the COMAH Regulations (Ref 22-3) contained criteria for a major accident which would require notification to the European Commission. Following the exit of the UK from the European Union, this schedule was revoked and such notification is no longer required. Notwithstanding this, this information has been adopted as useful criteria in the identification and assessment of MA&D.

22.4.8 Criteria for a major accident includes the following based on the European Seveso III Directive on the Control of Major Accidents (Ref 22-5):

a. An injury to a person which is fatal.

b. Up to six persons are injured within the establishment and hospitalised for at least 24 hours.

c. One person outside the establishment is hospitalised for at least 24 hours.

d. A dwelling outside the establishment is damaged and is unusable as a result of the accident.

e. The evacuation or confinement of persons for more than two hours, where persons × hrs is at least 500.

f. The interruption of drinking water, electricity, gas or telephone services to persons for more than 2 hours, where persons × hours is at least 1,000.

g. Damage to property in the establishment, to the value of at least €2million.

h. Damage to property outside the establishment, to the value of at least €500,000.

22.4.9 The criteria for damage to the environment, which could be considered to represent a MA&D are also listed in Schedule 5 of the COMAH Regulations (Ref 22-3) and include the following benchmarks:

a. Permanent or long-term damage to terrestrial habitats involving:

   i 0.5 hectares (ha) (equivalent to 5,000 m^2) or more of a habitat of environmental or conservation importance protected by legislation.

   ii 10 or more hectares of more widespread habitat, including agricultural land.

b. Significant or long-term damage to freshwater and marine habitats involving:

   i 10km or more of river or canal.

   ii 1 ha or more of a lake or pond.

   iii 2 ha or more of delta.

   iv 2 ha or more of a coastline or open sea.

c. Significant damage to an aquifer or underground water of 1 ha or more.

22.4.10 Guidance provided by the HSE on the PSR (Ref 22-6) defines a major accident in the context of a pipeline as follows:

a. A major accident would cover death or serious injury from a fire, explosion or uncontrolled emission from a pipeline. This includes both events which have escalated beyond the control of the normal operating envelope of the pipeline and those resulting from third party interference. Whether an event leads to serious danger to people will depend on factors specific to the incident. Major accidents to people can be distinguished from other accidents by the severity of the injuries, the number of casualties, or by the physical extent of the damage in areas where people may be present.

22.4.11 Guidance provided by IEMA (Ref 22-2) includes the following definition of a significant environmental effect in relation to MA&D:

a. Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration.

22.4.12 The definition aligns with that which was contained in Schedule 5 of COMAH Regulations explained above (Ref 22-3).

Approach

22.4.13 The assessment of MA&D has involved the following steps:

a. Collation and review of baseline information pertaining to the hazardous properties of the substances (and their consequences) which are expected to be present during the construction and operation phases of the Project. The hazardous properties of the substances are informed by their classification in accordance with the Classification, Labelling and Packaging (“CLP”) Regulations (Ref 22-18).

b. Identification of hazards and threats based on the design work completed to date and in accordance with industry standard approaches to hazard identification.

c. The determination of the study area and assessment of the Project’s location in relation to the sensitivity of the environment and the potential for natural disasters, such as meteorological hazards, seismic events and climate change impacts was initially considered within the Scoping Report.

d. A review of the conclusions of the scoping and preliminary assessments to identify which natural disasters would be credible MA&D scenarios. The meteorological hazards assessed include the following:

i Flooding following heavy rainfall events (including fluvial, surface water, groundwater, river and sewer flooding).

ii Storms and high wind speeds.

iii Drought, heatwave and extreme humidity.

iv Extreme cold and snow conditions.

v Lightning and electrical storms.

vi Reduced visibility, such as severe fog.

e. An assessment of the potential impacts to and from neighbouring industrial facilities, which includes sites regulated by the COMAH Regulations (Ref 22-3) and PSR (Ref 22-6) i.e. the consideration of the local cluster of industrial sites.

f. Screening of hazards and threats, including the likely significant effects.

g. Assessment of the potential magnitude of impacts that result from credible scenarios, to identify those which may be significant and within the criteria benchmark for a MA&D. The output is a schedule of Risk Events, for which mitigation measures are considered.

h. For credible MA&D scenarios, measures to prevent, minimise and/or mitigate risk have been outlined in this assessment, so far as is possible. Embedded mitigation measures include engineering design by using industry standards, procedural controls and maintenance, fire and gas detection, fire protection and others.

i. Following consideration of the outlined mitigation measures, the residual risks are identified, and a conclusion reached on the tolerability and significance of the residual risks to determine if risks have been reduced to ALARP. A judgement is also provided as to whether these risks constitute significant environmental effects.

22.4.14 The conclusions of the assessment include qualitative and quantitative assessments of the significance of identified foreseeable credible events and the residual risks after mitigation measures are taken into account. Risk management will be part of an ongoing process throughout the lifecycle of the Project and a requirement for compliance with applicable legislation. For example:

a. Operators of COMAH installations are required to demonstrate within a Safety Report submitted pursuant to the COMAH Regulations that the risks associated with the facility have been comprehensively assessed and a conclusion has been reached on the tolerability of risk, including the sufficiency of measures to ensure risk is reduced to ALARP. It is a regulatory requirement that all measures necessary must be taken to reduce risk at COMAH installations and Safety Reports must be updated and resubmitted to the Competent Authority, comprising of the HSE and EA for review every five years, or in other circumstances including prior to any modifications to the establishment or changes to the safety management systems which could have significant consequences for major accident hazards.

b. Installations which carry out one or more defined prescribed activities are subject to the EPR (Ref 22-24), which will apply to the Project. This legislation requires operators to supply detailed information to the regulator (the Environment Agency) in the form of a permit application and only when the application is fully determined and the relevant environmental permit granted, is operation allowed to commence. Compliance with EPR requires

operators to regularly submit information and data such as emissions monitoring results to the Regulator to confirm the Site is operating within permitted limits (as set out in the environmental permit).

c. The Hazardous Substances Regulations (Ref 22-7) require operators to assess the inventory of defined hazardous substances which could be present at the Site against controlled quantities. If the inventory exceeds the controlled quantities, operators are required to obtain an HSC. An application is made to the Hazardous Substance Authority (normally the local planning authority) which is responsible for enforcement. The application must include a description of substances, operations and the identification of the hazards associated with the Site and relevant safety information. For the Project, an application for the Hazardous Substances Consent for the Project has been submitted to NELC.

d. Compliance with the PSR (Ref 22-6) requires operators to operate in accordance with a defined Safety Management System ("SMS") for the pipeline(s) which includes the production of a MAPD. This document must be developed during design to incorporate means to demonstrate that the risks of identified hazards have been evaluated and appropriately managed via means such as inspection. The PSR (Ref 22-6) require performance standards to be established and safety information regularly audited.

Limitations and Assumptions

22.4.15 This assessment has identified the credible, worst-case Risk Events relevant to the Project. The risk of these events is required by legislation to be reduced to a level demonstrated to be ALARP through the careful design and operation of the facilities. At this stage in the Project design the facilities have not yet been fully specified, therefore standard industry approaches to managing risk which are typically adopted at COMAH installations, and which will be required to ensure legislative compliance, have been assumed. These are explained in detail in **Table 22-5**.

22.4.16 The assessment has been based on the hazardous substances expected to be present on site (Jetty and landside) during the construction and operational phases. The quantities of these substances are likely to vary during the Project's development, as the terrestrial phases of the green hydrogen production facility is expanded and built out, although the means of storage and transport would not be expected to vary.

22.4.17 When in operation, the jetty and associated facilities may be used to import and export CO_2 as a bulk liquid from carbon capture and storage installations. CO_2 is not a prescribed substance under COMAH but was assessed in the accident scenarios as it has hazard potential .The risks to individuals and the marine environment from accidental CO_2 releases at the jetty individually and in combination with ammonia has been assessed and considered to be within the 'broadly acceptable region' and ALARP measures and emergency planning for accident scenarios involving both CO_2 and ammonia on the jetty are no more onerous than those for ammonia in isolation

22.5 Study Area

22.5.1 The extent of the study area for the assessment of MA&D is not defined within regulatory guidance or standardised methodology. Accordingly, an area defined by a radius of 5km from the Site Boundary has been applied based on experience and professional judgement in light of the circumstances set out below.

22.5.2 The extent of this study area takes into consideration the proximity of protected environmental receptors such as the Humber Estuary, industrial sites (which include the Humberside cluster of COMAH installations and Major Accident Hazard ("MAH") pipelines) and the residential area of Immingham. These receptors are all located within a 5km radius of the Site Boundary. Expanding the study area beyond 5km would not introduce new categories of receptor or more sensitive receptors of relevance to the assessment.

22.5.3 The study area is shown in **Figure 22.1 [TR030008/APP/6.3]** which identifies nearby major hazard sites, pipelines, and other sites whose land use planning zones may encroach on any part of the Project.

22.5.4 There have been minor changes to the Site Boundary and therefore the study area for MA&D since the publication of the Scoping and PEI Reports (**Appendix 1.A [TR030008/APP/6.4]**). These changes have made no appreciable impact on the study area or the assessment of MA&D.

22.6 Baseline Conditions

Overview

22.6.1 The current baseline environment for the consideration of MA&D has been established through a review of existing information sources. Within the study area shown in **Figure 22.1 [TR030008/APP/6.3]**, industrial facilities are present which are regulated as major accident hazard establishments through the COMAH Regulations (Ref 22-3), as well as major accident hazard pipelines regulated in accordance with the PSR (Ref 22-6). These installations and their corresponding hazards are therefore important factors being taken into consideration as part of the ongoing development of the Project design, in discussion with key stakeholders such as the regulatory authorities, including the HSE and EA.

Existing Baseline - Infrastructure and Industrial Sites

22.6.2 The industrial area of Immingham contains a number of COMAH sites which are regulated in accordance with the COMAH Regulations (Ref 22-3). The numbering of sites [#] corresponds to the locations identified on **Figure 22.1 [TR030008/APP/6.3]**:

a. [1] The Humber Refinery operated by Phillips 66 is located approximately 4 km in a westerly direction from the Site and processes crude oil to produce gasoline, diesel and aviation fuels as primary products.

b. [2] The Lindsey Oil Refinery operated by Prax Ltd is located approximately 5km in a westerly direction from the Site and undertakes similar operations to the Humber Refinery.

c. [3] The Humber LPG Terminal and underground gas storage caverns also operated by Phillips 66 Ltd, located approximately 4km from the Site in a westerly direction.

d. [4] Immingham Docks operated by ABP which comprises a number of discrete operational areas, some of which are COMAH Installations. These facilities store commodities including bulk fuels and fertilizer and include:

   i [4a] IOT) operated by Associated Petroleum Terminals ("APT"), located directly adjacent to the Site. The IOT Jetty and much of the connecting pipework to the nearby refineries is operated as a joint venture on behalf of Phillips 66 and Prax Ltd.

   ii Exolum Immingham Limited (formerly Inter Terminals Ltd) located 1.5km (east terminal [4b]) and 2km (west terminal [4c]) in a westerly direction from the Site.

e. [5] Tronox Pigment UK Ltd operate a chemical manufacturing facility located approximately 1km south-east of the Site.

f. [6] Air Products operate a facility for the manufacture and storage of industrial gases including oxygen and nitrogen which is located approximately 1.5km from the Site in an easterly direction.

g. [7] BOC operate a facility for specialty gas manufacturing and storage operations, located approximately 2km south-east of the Site.

h. [8] The South Humber Bank Power Station owned by EP UK Ltd which is a combined cycle gas turbine ("CCGT") facility supplied by a high pressure gas pipeline, located approximately 2.5km south-east of the Site.

i. [9] Synthomer Ltd operate a chemical manufacturing facility, producing substances such as adhesives and coatings. Location is approximately 2.5km south-east the Site.

22.6.3 The major accident hazard pipelines located in the study area are used to transport gas and petroleum products. These include a high-pressure gas pipeline operated by National Grid located approximately 4km from the Site, in a south-easterly direction, routed to the South Humber Bank Power Station [8]. National Grid also operate 400kV overhead electrical power distribution systems in the vicinity of the Site Boundary.

22.6.4 There are no major airports located within the vicinity of the Project, the closest airport being Humberside which is located approximately 12km in a south-westerly direction. The flight path for services at this airport and other routes crosses the industrial area of Immingham and the Humber Estuary.

22.6.5 In addition to the major accident hazard sites and pipelines, the baseline area consists of critical road, rail and seaport infrastructure and is an important industrial area within the UK. The Port of Immingham [4] currently handles thousands of ship movements per year, including the import of significant quantities of liquid and gaseous fuels. The Port of Immingham is located directly adjacent to the Project, and comprises loading and offloading jetties, bulk storage tanks for hydrocarbon liquids and fertiliser storage. Subterranean caverns [3] for the storage of liquefied petroleum gas ("LPG") are located approximately 3.5km in a westerly direction from the Project.

Existing Baseline – Natural Features and Protected Environmental Sites

22.6.6 The potentially credible disaster scenarios relevant to the Project are largely related to the existing natural features and proximity of protected environmental sites/receptors.

22.6.7 The UK experiences very low levels of seismic activity and there are no significant seismic events recorded by the British Geological Survey ("BGS") for the Humberside region at the nearest seismic monitoring location which is sited approximately 10km south of Humberside Airport.

22.6.8 The Humber Estuary [10] is classified as a Special Protection Area and is a designated Ramsar Site. The estuary is directly adjacent to the Project and contains areas which are designated as Special Areas of Conservation ("SAC") and Sites of Special Scientific Interest ("SSSI"). The wetland areas of the estuary support internationally important numbers of waterfowl in the winter, including golden plovers, and hosts the second largest colony of grey seals in the UK. An incident which has an impact on these receptors could satisfy the criteria for a disaster, and therefore requires consideration.

22.6.9 The bedrock groundwater within the Site Boundary is designated as a principal aquifer via the BGS and EA classification system. This designation corresponds with the most important type of groundwater which supports drinking water supplies and ecosystems. Potential impacts to groundwater are considered within the assessment of Risk Events.

22.6.10 The Humber Estuary is tidal and situated on low-lying land, therefore at risk of tidal flooding. Significant investment has been made in flood defences for this area; however continued efforts are required to combat the potential impacts of climate change. Currently, the flood risk level defined by the EA in the area of the Project is Low to Medium from rivers and the sea, therefore the potential impact of flooding on the Project is considered in this assessment.

22.6.11 Climate change resilience is being incorporated in the design of the Project as necessary. The expectations of the COMAH Competent Authority ("CA") (being the HSE and the EA) are that operators will include an assessment to identify and assess Major Accidents to the Environment ("MATTE") within their Safety Report for the Project. MATTE could include those initiated by climate change consequences, e.g. rising river levels. The assessment of MATTE will contain information on how natural events could directly or indirectly cause a MATTE. Best practice for the methodology to carry out this assessment is provided within

the CDOIF Guidance, which is recognised by the COMAH CA, described in **Table 22-2**.

22.6.12 There are no World Heritage Sites, Scheduled Monuments, Grade I listed buildings, conservation areas, registered parks and gardens, registered battlefields, or protected wreck sites within the 2km study area for designated heritage assets. A detailed assessment of heritage sites is contained in **Chapter 14: Historic Environment (Terrestrial)** and **Chapter 15: Historic Environment (Marine) [TR030008/APP/6.2]**.

Existing Baseline – Human Health and Safety

22.6.13 Immingham is the nearest town to the Project and has a population of around 11,728, located approximately 1.5km in a south-westerly direction. The conurbations of Grimsby (southeast) and Hull (north-west) have populations of around 86,105 and 287,705 respectively.

22.6.14 The closest residential premises to the Project are located on the west side of Queens Road within the western side of the Site and these are listed in **Chapter 2: The Project [TR30008/APP/6.2].** A large number of residential properties are also located approximately 500m to the west of the Site Boundary on the eastern edge of the town of Immingham.

22.6.15 Population and human health receptors include persons present on site during construction and operation as well as the wider external population. Persons present on neighbouring industrial facilities have also been taken into consideration. Off-site sensitive receptors include vulnerable locations such as hospitals, care homes and schools, of which there are a number within the town of Immingham but none closer than 3.5km from the Site. The nearest such sensitive receptor is the Immingham Day Nursery [11].

Future Baseline - Infrastructure and Industrial Sites

22.6.16 The future baseline of the area may include potential new developments located in and around the areas of Immingham, North and South Killinghome and Stallingborough. The IERRT is a development currently going through a separate DCO process and is associated with the development of the Port of Immingham. This facility would primarily service commercial cargo, with some use by passengers (members of the public) and involve construction and operation of marine and landside infrastructure. Further details are contained within **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

22.6.17 The nature of the area around Immingham provides an attractive location for major projects and therefore additional industrial developments could be brought forward in future subject to consideration of land use planning zones.

22.7 Project Design and Impact Avoidance

22.7.1 The following impact avoidance measures comprise specific measures incorporated into the Project design (embedded mitigation), and best practice construction or operational measures (standard mitigation) that are typically included within industrial developments similar to the Project. At all stages of the Project appropriate formal risk assessment study processes, for example, Safety in Design, Hazard Identification ("HAZID"), Hazard and Operability ("HAZOP"), Hazards in Construction ("HAZCON") and ultimately ongoing Process Hazard Assessment ("PHA") will be undertaken. The Safety Report submitted to the Competent Authority will require the operator to demonstrate that these risk assessments have been undertaken.

22.7.2 These embedded and standard measures have therefore been taken account of in the impact assessment process on the basis that they will be delivered and implemented as part of the Project.

Design

22.7.3 During the Project design process, a number of design risk assessment studies (see **paragraph 22.7.1** above) with regard to process safety and safeguarding, isolation, emergency shutdown, and if required, depressurisation have been developed by Air Products for the hydrogen production facility and associated jetty topside infrastructure (and would be a requirement of the Safety Case Report to be submitted before construction under the COMAH Regulations).These hazard study methodologies follow an industry best practice approach in design safety and contribute in developing a satisfactory duly made COMAH Safety Case Report to demonstrate ALARP (As Low as is Reasonably Practicable).

22.7.4 Engineering philosophies produced for the process systems set out the standards to be applied in the design of equipment and pipework containing hydrogen and ammonia and would be a requirement of the Safety Report, including:

a. Design of ammonia storage in accordance with American Petroleum Institute ("API") 625 Tank Systems for Refrigerated Liquefied Gas Storage (Ref 22-33) which incorporates safety systems such as integral containment also known as 'double-skin' construction. This prevents a release of ammonia in the event of a failure within the primary containment area.

b. The ammonia storage tank is currently the subject of a Best Available Techniques ("BAT") assessment, being carried out by a specialist to determine the most appropriate design. The output of this assessment will be documented within the Environmental Permit application for the Project.

c. Emergency pressure relief systems for refrigerated storage tanks will also be designed in accordance with API 625 (Ref 22-33).

d. Pressure relief systems and devices will be designed in accordance with API 520 Sizing, Selection, and Installation of Pressure-Relieving Devices (Ref 22-34) and API 521 Pressure relieving and Depressuring Systems (Ref 22-35).

e. Liquid hydrogen process and storage facilities will be designed in accordance with guidance published by the EIGA document reference 06/18 (Ref 22-36).

22.7.5 The Project design process involves a number of process safety studies. A description of the studies which have been carried out for the Project to date is contained in **Section 22.8** along with a summary of how these studies will be developed as the engineering design of the Project is progressed. **Section 22.8** describes the formal process safety reviews which include HAZID and HAZOP which are a standard approach to risk management and have been applied to the engineering design of industrial facilities in the processing industries worldwide for decades. The objective of these assessments is to identify, eliminate, prevent or minimise hazardous scenarios through appropriate design during all stages of the facility lifecycle, from concept and Front End Engineering Design ("FEED") studies, progressing through detailed design, construction, operational and eventual decommissioning phases.

22.7.6 A Major Accident Prevention Plan ("MAPP") will be prepared to support the notification to the HSE of the hydrogen production facility as a COMAH establishment. This document is a high level policy statement which establishes the commitments made by the management team for the COMAH establishment to the prevention of major accidents. The commitments within the MAPP are delivered by the Safety Management Systems ("SMS") for the establishment, which comprises operational and emergency procedures. These documents will be reviewed by the COMAH CA to establish if they are suitable and sufficient to permit operation of the Project.

22.7.7 A MAPD will be developed for the pipelines. This is a comprehensive report which includes assessments to demonstrate that the hazards associated with the pipelines with the potential for a major accident have been identified and evaluated, and the risks reduced to ALARP. This document also includes a description of the SMS which applies specifically to the pipeline.

22.7.8 The CDM regulations (Ref 22-8) will be followed as required throughout the design phase which includes the development of design Risk Register(s). These are live documents, maintained by the Project Manager throughout the design and construction phases of projects to identify and document risks, assign ownership, priority and mitigation measures.

Construction

22.7.9 Formal risk assessments to identify potential hazards during construction ("HAZCON") are typically carried out prior to completion of the design phase for process facilities such as the Project to ensure compliance with the COMAH Regulations. This will involve development of the pre-construction information package to be included in the tender documents for review by the Principal Contractor. Once appointed, the Principal Contractor will develop a Construction Phase Plan in compliance with CDM Regulations. It is anticipated that the construction of this facility will be a HSE notifiable project.

22.7.10 During construction, a formal risk assessment of the potential hazards of simultaneous operations ("SIMOPS") will be carried out (in order to comply with the CDM Regulations) where activities at the Project are in close proximity to

existing operational facilities and there is a potential for conflict. This risk assessment will involve representatives from the Project alongside stakeholders such as neighbouring facilities, electricity and gas transmission specialists where there are existing high voltage electrical systems and gas pipelines and others as appropriate.

22.7.11 Established protocols will be used (to comply with HSWA) to develop Safety Systems of Work for activities carried out in the vicinity of high pressure ("HP") gas transmission pipelines and high voltage ("HV") electricity transmission systems. These protocols include guidance documents published by the HSE, National Grid and other network operators.

a. HP gas pipelines can operate at pressures up to 90 barg and are normally buried to a depth of at least 1.1 m. An excavation of 0.3 m or more above the pipeline must have prior agreement with the pipeline operator whose representative will typically be on site while the work is in progress to provide information and supervise activities.

b. HV electrical cables operate at voltages up to 400 kV and can either be connected to overhead transmission systems or buried below ground level. There are defined clearance distances to be observed between these cables and any structure or work activity.

22.7.12 The use of suitably experienced contractors, risk assessments, working method statements, operating procedures and personnel training minimise the risk of accidental scenarios occurring during construction of the Project.

22.7.13 An Outline CEMP has been prepared **[TR030008/APP/6.5]** as part of the DCO application. This sets out how construction measures and activities would be managed and controlled in compliance with accredited health and safety and environmental management systems, relevant legislation and environmental permits, consents and licences. Requirements in the draft DCO **[TR030008/APP/2.1]** will ensure that the Final CEMP is prepared substantially in accordance with the content of the Outline CEMP **[TR030008/APP/6.5]** and complied with.

Operation

22.7.14 As noted above, a HSC issued by the local authority, a COMAH Safety Report and pipelines MAPD approved by the HSE, and an Environmental Permit issued by the EA would be required for the operation of the Project. These consents and documents require a number of stipulations and requirements to be fulfilled to the satisfaction of the regulators, including the use of appropriate control and monitoring procedures, risk assessments, management systems and control measures to minimise the risk of accidents occurring and to minimise the effects of any such accidents on off-site receptors as well as the operational workforce. The Environmental Permit would require the approach to managing accidents and emergencies to be in accordance with BAT.

Decommissioning of the hydrogen production facility

22.7.15 Similarly with construction and operation, formal process safety studies and risk assessments would be carried out to identify potential hazards prior to decommissioning and demolition of the hydrogen production facility. These studies would be carried out in accordance with industry best practice such as Hazards of Demolition ("HAZDEM"). These studies are typically prepared by a team of specialists to identify potential hazards, consider the associated risks and specify the appropriate mitigation and control measures required. As explained in **Chapter 2: The Project [TR030008/APP/6.2]**, the jetty, which comprises the Nationally Significant Infrastructure Project, would not be decommissioned, as it would become part of the port infrastructure and would be maintained and refurbished as necessary in accordance with this status.

22.8 Assessment of Likely Impacts and Effects

22.8.1 This section describes the hazardous properties of the substances which would be present on site during the lifecycle of the Project and potentially hazardous activities which have the potential to be a credible major accident scenario.

Construction

22.8.2 The potentially harmful substances which would be present during the construction phase include liquid cement and diesel fuel oil.

22.8.3 Cement and mixed liquid concrete is classified as an irritant to skin as contact can cause alkali burns. This substance can harm the eyes and the respiratory system via inhalation of dust and if cement or wet concrete enters drains or watercourses, there is the potential to cause harm to the environment via an increase in the pH of water.

22.8.4 Diesel is likely be used within mobile power generators, construction plant and construction vehicles, even if it is possible that some of the construction plant and vehicles will use alternative power sources. This substance is classified as a flammable liquid and harmful to the aquatic environment. A release which is ignited could cause harm to people via exposure to thermal radiation in a fire, or if unignited, diesel can cause harm to people if inhaled, ingested or exposed to skin. A release of diesel to the environment such as the Humber could result in harm to flora and fauna.

22.8.5 Construction work can include potentially hazardous activities such as working near to overhead power supplies or buried services such as power cables and gas transmission mains. Accidents have occurred historically due to contact with HV electricity supplies, the collapse of excavations and structures during construction which have resulted in fatal injuries to workers on site.

Operation

22.8.6 When operational, the terminal would receive consignments of liquefied refrigerated ammonia delivered via ship to the jetty, where it would be transferred for storage in tanks onshore prior to use. Hydrogen gas would then be produced by the splitting of ammonia within process operations using the hydrogen

production units described in **Chapter 2: The Project [TR030008/APP/6.2]**. The hydrogen gas would then be cooled and liquefied prior to filling into bulk road tankers for delivery to end users. The hydrogen gas would also be directly compressed and transported in tube trailers or used for refuelling Air Products own tankers on Site. Hydrogen gas may also be delivered by pipeline to local customers, but this system would be subject to any separate applications for consents as may be necessary, and therefore is not included within this assessment.

22.8.7 Utility services supporting hydrogen production operations would include compressed air, nitrogen, natural gas (used as a source of energy, at least in the initial stages of the Project) and electrical power supplies. Cooling water would also be used, which would be circulated in a closed loop through the process with a purge stream to maintain water quality. Process wastewater would be treated on Site prior to discharge to the local sewerage system. Water would also be stored for the purposes of firefighting. Small quantities of substances such as biocides and scale inhibitor would be used to treat water on Site for use in the process, and while these substances can be categorised as dangerous to humans and the environment, the quantities used on Site are expected to be small.

22.8.8 Refrigerated anhydrous ammonia is classified as a flammable gas however the primary hazard associated with this substance is related to its toxicity. If released, ammonia can form explosive mixtures in air if allowed to accumulate in confined spaces. Ammonia does not however sustain combustion.

22.8.9 Ammonia is toxic to people if inhaled and causes severe skin burns, eye damage and respiratory irritation. It can be harmful to flora and fauna.

22.8.10 Ammonia is toxic to the environment if released to water and is incompatible with certain substances, such as oxidants e.g. sodium hypochlorite (bleach), which reacts with ammonia to release chlorine gas. No ammonia incompatible substances would be present in significant quantities on Site.

22.8.11 The most common cause of injuries to people associated with ammonia are as a result of gas inhalation. Serious incidents involving ammonia are rare events, when considering the very large number of operating hours of facilities handling ammonia in continual industrial processes. Where they have occurred, extensive investigations are carried out to identify lessons which can be learned to improve safety within industrial usage. Examples of such incidents include the ammonia release at a Petronas facility in Malaysia (Ref 22-14) and the Medicine Hat facility in Canada (Ref 22-15).

22.8.12 Hydrogen is an extremely flammable gas, with a wide flammable range (4% to 77% by volume) and can form explosive mixtures in air. The hazardous properties of hydrogen are well understood by industrial operators and there is a substantial body of safety regulation and industry guidance associated with the equipment used to store and use this material. Serious incidents involving hydrogen are rare. An example of an incident involving a release of hydrogen is the explosion at a chemical manufacturing facility in Illinois in 2019 (Ref 22-16).

22.8.13 Natural gas used as a source of fuel for the hydrogen production units is classified as extremely flammable and can form explosive mixtures in air. The consequences of a loss of containment of natural gas would be substantially similar to hydrogen, however the quantity of hydrogen would be substantially greater than natural gas, if a release were to occur. Legislative controls and engineering standards for equipment and pipework design and other mitigation measures to reduce risk are very closely aligned with those for hydrogen and consequently this assessment focuses on hydrogen as the primary flammable gas.

22.8.14 When in operation, the jetty and associated facilities may be used to import and export CO_2 as a bulk liquid from carbon capture and storage installations. This system would be subject to any separate applications for consents for associated landside development and any permits as may be necessary. Unlike ammonia, CO_2 is not a prescribed substance under COMAH Regulations and ALARP measures and emergency planning for accident scenarios involving both CO_2 and ammonia together are no more onerous than those assessed for ammonia in isolation.

22.8.15 Small quantities of substances such as mineral and synthetic lubricating and hydraulic oils would be used for equipment on Site with moving parts, such as pumps and compressors. These fluids are not generally categorised as hazardous and are of low flammability but are combustible in the event of a fire and may cause harm to the environment if released to water. The quantity of these materials is, however, expected to be small and would typically be stored in containers not exceeding 1,000 litres capacity as well as water treatment chemicals including small qualities of acid, hypochlorite and biocides which would be stored in bunded containers.

22.8.16 Process operations would include hazardous activities by virtue of the dangerous substances present on Site. A robust SMS is a requirement of the COMAH Regulations (Ref 22-3) and would be in place prior to operation to ensure operational risks are reduced to ALARP.

Jetty and Marine Operations

22.8.17 The vessels used to deliver refrigerated ammonia would be Very Large Gas Carriers (“VLGCs”). In order to assess a worst case and particularly in relation to the climate change considerations (see **Chapter 19: Climate Change [TR030008/APP/6.2]**), it is assumed that the VLGC, would initially be powered by marine fuel oil (“MFO”) which is a liquid hydrocarbon mixture similar to diesel fuel. If released, MFO is toxic to the aquatic environment, it is classified as a flammable liquid and vapour and is harmful to people. In the longer term, it is anticipated that the existing VLGC fleet for ammonia imports would be replaced by a fleet powered by sustainable low carbon fuels. Over the long term, a similar transition can be expected across the marine fleet, to include similar vessels in the carbon capture sector which are expected to use the new terminal.

22.8.18 VLGC vessels would contain ballast water which provides stability. This water can be contaminated with biological material such as pathogens native to the water of the country of origin of the delivery vessel. The vessel would also

contain grey water from washing and black water from toilet facilities. If released to the Humber, these waste waters could be harmful to the environment.

22.8.19 Jetty loading/offloading systems typically contain hydraulic oils, which are synthetic, non-flammable fluids. If released to water, these could potentially cause harm by forming a film on the surface which inhibits oxygen transfer. The quantities of hydraulic fluids present in the systems would be small and any release would be considered trivial, and an accidental release would be unlikely to reach the criteria for a potential major accident to the environment. Control of pollution during the operational phase of the Project is covered further in **Chapter 17: Marine Water and Sediment Quality** and **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

22.8.20 The operational activities carried out at the jetty and the VLGC would, in relation to the hydrogen production facility, primarily be the offloading of refrigerated ammonia. This would be undertaken in a substantially similar manner to the loading and offloading of hazardous gases undertaken for many years at the Port of Immingham, in accordance with established safety procedures.

Demolition of the hydrogen production facility

22.8.21 The hazards associated with activities carried out during demolition are substantially the same as construction, however, as the process equipment and pipework have contained dangerous substances, additional safety precautions are required. These include gas purging, venting and cleaning processes and catalyst removal to ensure no hazardous substances remain prior to dismantling and demolition.

22.8.22 **Table 22-4** presents the results of the assessment of the hazardous properties of substances and activities, geographic location of the Project and the baseline study area, to identify credible MA&D scenarios, termed “Risk Events”. Further analysis of Risk Events will be undertaken to support the COMAH Safety Report and relevant Safety Case(s).

Table 22-4: Identification of Major Accident & Disaster Categories

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
Construction Activities Credible hazard categories associated with construction activities include accidental damage to existing service infrastructure such as electrical power, gas and oil pipelines. Consequences of such incidents generally depend on the extent of contact made and proximity of people and sensitive receptors.			

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
1	Release of Raw Materials used in Construction Activities A release of construction materials e.g. liquid concrete, diesel (used for power generation). Potential for minor harm to people if exposed to liquid cement, and/or diesel. Potential for minor harm if substances released to environment (due to quantities likely to be released).	Potential minor impact to human health (on-site workers) and environmental receptors on Site.	No
2	Construction Activities – Electrical Systems Strike Impact with overhead electrical transmission system e.g. crane impact on high voltage (HV) electrical cable or underground cable strike during excavation. Potential for harm to people including fatal injuries. Potential interruption to local electrical power supplies.	Potential significant impact to human health and safety on Site. Interruption to local power supplies.	Yes Risk Event 1
3	Construction Activities – Underground Gas Main/ Unexploded Ordnance (“UXO”) Strike Impact with underground gas main during excavation activities. Potential for UXO on the Site. Potential for a significant release of gas leading to fire and/or explosion, with harm to people including potential for fatal injuries. Potential explosion in event of UXO strike. Potential interruption to local gas supplies.	Potential significant impact to human health and safety on-Site and off-Site. Interruption to local gas supplies.	Yes Risk Event 2
4	Construction Activities – General/Other Incident during construction e.g. structural collapse of building(s), excavation collapse, collisions from construction vehicles. Potential for significant harm to people on-site (construction workers) including potential for fatal injuries.	Potential significant impact to human health and safety on-Site.	Yes Risk Event 3
Operational Activities (Commissioning and Commercial Operation) Credible hazard categories associated with process equipment failure, malfunction, accidental damage, vehicular impact, disturbance etc., resulting in the loss of containment of hazardous substances. The consequences depend on the type and quantity of substance released, which are considered below as fire/explosion/toxic release/environmental harm.			

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
5	Fire Significant loss of containment of ammonia, hydrogen or natural gas which immediately finds a source of ignition. Potential for harm to people including fatal injuries. Potential for harm to the environment via release of contaminated firewater. Potential for damage to assets including buildings. Potential for domino effect, escalation to other areas on-site and off-site including nearby COMAH installations.	Potential significant impact at: Human health and safety – on-Site & off-Site populations. Environment - Humber Estuary	Yes Risk Event 4
6	Explosion /Energy release Significant loss of containment of ammonia, hydrogen or natural gas which accumulates, and ignition is delayed, resulting in an explosion. Impact depends on release point and level of congestion within process structures on-Site. Potential for harm to people including fatal injuries. Potential for damage to assets e.g. overhead power transmission systems, with subsequent loss of power to neighbours. Potential for domino effect, escalation to other areas on-Site and off-Site including nearby COMAH installations.	Potential significant impact at: Human health and safety – on-Site and off-Site populations. Environment – Humber Estuary	Yes Risk Event 5
7	Toxic (Ammonia) Release Significant loss of containment of ammonia gas from onshore facilities. Consequences include potential for significant harm to people exposed to high concentrations of ammonia gas. Potential for harm to people including fatal injuries. Rainout and/or dissolution in air to form ammonium hydroxide therefore potential for harm to the environment. Emergency services may issue shelter in place orders for neighbours until the incident has been resolved.	Potential significant impact at: Human health – on-Site and off-Site populations. Environment - Humber Estuary, soil and groundwater.	Yes Risk Event 6

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
8	Asphyxiant (Nitrogen) Release Significant loss of containment of nitrogen gas from onshore facilities. If released into a confined area on-site where people are present, there is the potential for a release of nitrogen to result in harm via asphyxiation. If released to an open area, this gas would disperse, and concentrations would reduce to level which would not cause harm. Potential for harm to onsite workers including fatal injuries. In all scenarios, the concentrations of nitrogen at off-Site receptors would not be sufficient to cause harm to people or the environment. Design and operational measures provide high integrity containment systems and measures for safe disposal of nitrogen, therefore not considered a credible MA&D scenario.	Potential significant impact at: Human health – on-Site.	No
9	Release of Substances into the Marine Environment Scenarios include an accidental loss of containment of marine fuel oil or black grey/ballast water from marine transport. Incidents involving vessels at sea and during berthing could cause a loss of containment for example via accidental impact with other vessels or port infrastructure. A release of flammable substances could result in a fire if ignited, causing harm to people and the environment. A release of ammonia could have a significant impact on people onboard the vessel and at the port. Potential for harm to flora and fauna located at the Humber Estuary. The substances present on board vessels associated with the Project have potential for harm to the water environment if released, via an increase in Chemical and or Biological Oxygen Demand (COD/BOD) levels.	Potential significant impact at: Human health and safety (fire which affects persons on board vessel and/or at jetty). Environment - Humber Estuary.	Yes Risk Event 7

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
10	Loss of Containment of Transported Dangerous Goods (by road) Collisions/accidents involving road tankers containing hydrogen causing loss of containment, potential subsequent fire and/or explosion. Potential for significant harm to people in the vicinity of the incident who are exposed to high levels of thermal radiation and/ or explosion overpressures. Potential for damage to property located near to incident. Emergency services may close roads and potential to interrupt power and water supplies in the event of damage to infrastructure.	Potential significant impact at: Human health and safety population (off-Site).	Yes Risk Event 8
Decommissioning Activities Credible hazard categories associated with decommissioning activities include accidental damage to existing service infrastructure such as electrical power, gas and oil pipelines.			
11	Decommissioning Activities – Dismantling Vessels and Pipework Incident occurring during decommissioning e.g. dismantling pipework and vessels using equipment which could generate a spark such as electrical grinders and saws. If systems have not been fully de-inventoried or isolated i.e. still contain flammable material there is the potential for fire and/or explosion causing harm to people on-Site. Causes include operator errors or lapses, failure in safety management systems. Failure to isolate electrical supplies prior to work on site could also result in harm to workers e.g. electrocution, arc flash injury.	Potential significant impact to human health and safety on-Site.	Yes Risk Event 9
Disasters Credible disaster categories include intentional malicious damage to assets and infrastructure (e.g. vandalism) and potential impacts of adverse weather including future climate change effects. Consequences of such incidents generally depend on the extent of the harm caused, the proximity of people and sensitive receptors.			

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
12	Malicious Damage/Conflict/Arson Various scenarios resulting in loss of containment of hazardous substances such as malicious damage to process storage tanks or pipework including Theft/malicious damage /terrorist threat - external interference - (damage to the pipelines/power supplies) Consequences are considered above - see fire/explosion/toxic release scenarios.	Potential significant impact at: Human health and safety – on-Site and off-Site populations. Environment - Humber Estuary.	Yes (as fire/ explosion/ toxic release). Considered in Risk Events 4, 5, 6
13	Domino Event Various scenarios such as fire and/or explosion at a neighbouring facility, such as the nearby oil storage terminal, high pressure gas pipeline or others which has an impact at the Site. This category of Risk Event also includes incidents initiated at the Site which could potentially escalate and have an impact at facilities within the local industrial cluster. The potential impacts to and from the Project can include loss of containment via thermal radiation related failure mechanisms or accidental impact damage from projectiles generated during an explosion.	Potential significant impact at: Human health and safety – on-Site and off-Site populations. Environment - Humber Estuary.	Yes (as fire/ explosion/ toxic release) Considered in Risk Events 4, 5, 6
14	Seismic Event/Landslide A seismic event such as an earthquake could cause structural damage to process equipment, pipework, infrastructure and buildings causing loss of containment. Consequences considered above in Risk Events 4, 5, 6.	Potential significant impact at: Human health and safety – on-Site and off-Site populations. Environment - Humber Estuary.	No (plant and equipment will be designed for the appropriate seismic zone).

Ref.	Hazard Category	Impact/Receptor	Credible MA&D
15	Storms/Flooding/Climate Change/Storm Surge Potential for pluvial and fluvial flooding which reaches the Site and overwhelms drainage systems. A major flooding event has potential to cause asset damage leading to loss of containment of dangerous substances. The consequences of such a loss of containment are considered above. Lightning strike during a storm has potential to cause ignition of highly flammable gas if this were to occur while material was being vented directly to atmosphere. This would however be a very unlikely event.	Potential significant impact at: Human health and safety – on-Site and off-Site populations. Environment - Humber Estuary	Yes Risk Event 10

22.8.23 The potential initiating causes and impacts from the MA&D scenarios identified in **Table 22-4** are considered in further detail within **Table 22-5**.

22.9 Mitigation and Enhancement Measures

22.9.1 Project objective (d) is to minimise adverse impacts on the environment and safeguard the health and safety and amenity of local residents. A number of additional mitigation measures, over and above the embedded and standard measures, are described in this section; these will contribute to the safe delivery of this objective.

22.9.2 The hydrogen production facility is being developed to produce green hydrogen to replace fossil fuels and natural gas, for use particularly in the UK's transport sector, where other sources of renewable energy cannot be used.

22.9.3 Hydrogen is highly flammable, and therefore the potential for Risk Events such as those identified in **Table 22-4** cannot be entirely eliminated. Risks must therefore be carefully controlled, and reduced to ALARP via mitigation measures, as required by the COMAH Regulations (Ref 22-3). Production of hydrogen employs ammonia, which is a commonly used industrial substance. Ammonia is a toxic material and there are associated risks with its use, however, these risks would be appropriately managed by applying safety and environmental control measures. Unlike ammonia, CO_2 is not a prescribed substance under COMAH regulations and ALARP measures and emergency planning for accident scenarios involving both CO_2 and ammonia together are no more onerous than those assessed for ammonia individually.

22.9.4 The additional mitigation measures employed to prevent a loss of containment for gaseous substances are substantially similar for ammonia, hydrogen and natural gas.

22.9.5 The additional mitigation measures associated with the identified credible MA&D scenarios for the Project are presented in **Table 22-5** and **Table 22-6**. The measures presented are not an exhaustive list, as it is not possible to provide full details of all the extensive safety assessments, infrastructure, systems and

processes that will be in place throughout the lifecycle of the Project. This list of additional mitigation therefore presents an overview of the key measures to illustrate how risk management will be undertaken during the continued engineering and design-development of the Project. The relevant measures will be identified in and secured through approval of and compliance with the CEMP, CDM Regulations, EPR and COMAH Safety Report plus Health and Safety at Work Act (HASW) 1974. In addition, the port itself has an Emergency Plan and there is also an Emergency Plan for serious marine incidents on the estuary.

Table 22-5: Assessment of Major Accident & Disaster Risk Event Scenarios

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
1	**Contact with high voltage (HV) electricity (overhead or underground)**	Contact with overhead electrical transmission system e.g. crane impact on HV electrical cable or underground cable strike during excavation. Contact with overhead HV electricity cables can occur via accidental contact with the jib of construction cranes. Similarly, during excavation, contact of an excavator bucket with underground electrical cable.	Potential for harm to construction workers including fatal injuries. Potential interruption to local electrical power supplies.	Project notifications would be communicated to utility service providers, including National Grid and others. This service ensures up-to-date information is available on the location of above and below ground electrical cables on drawings/maps. Locations of utilities will be confirmed by use of specialist tools to detect underground cables and pipes. During the construction phase of the Project, activities which would be carried out in proximity to HV electrical distribution networks would be carefully controlled via risk assessments. Appropriate techniques including hand-dig would be used as required by these risk assessments. Protective measures and safety signage would be used to alert personnel to overhead and below ground electrical hazards. Only suitably qualified and experienced personnel (“SQEP”) would operate	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				equipment such as cranes and excavators.	
2	**Contact with underground gas main or UXO**	Potential for UXO on Site and gas transmission infrastructure. Impact with gas main/UXO during excavation activities causing a release of gas and fire/or explosion.	Potential for harm to construction workers including fatal injuries. Potential for harm to people off-Site via thermal radiation/explosion projectiles. Potential interruption to gas supplies used for power generation and to local industry and residents.	Measures as Risk Event 1 for underground services such as gas mains. The Project would work with UK Gas Transmission services to ensure work is carried out safely where gas infrastructure has been identified as present. An UXO survey would be completed for the Site and any remedial activities safely completed prior to construction commencing.	**Yes**
3	**Construction incident – structural collapse, collision**	Incident such as structural collapse of building(s) and/ or process structures caused by inadequate design, accidental impact from vehicle, malicious interference and so forth. Excavation collapse caused by inadequate supports.	Potential for significant harm to construction workers including fatal injuries.	The engineering design of the Project, in particular civil and structural engineering would be carried out in accordance with all applicable legislative requirements and associated industry standards. Groundworks to ensure site stability would be carried out as part of the Project development. Equipment and vehicles used during construction would be carefully selected	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		Collisions with vehicles, such as overturning or when reversing.		and appropriate temporary construction access installed. Security controls would be in place throughout construction including guards and CCTV to prevent unauthorized access to Site.	
4	**Fire**	Significant loss of containment of flammable substance (principally hydrogen or natural gas) caused by accidental damage or failure of containment systems. Fire could also be initiated via malicious damage/conflict/arson. Potential for fire at a neighbouring major hazard installation to escalate to site via domino effect. Also, potential for fire at the Site to have an impact on neighbouring sites. Storm events such as flooding could initiate a	Potential for significant harm to people on-Site, including fatal injuries and harm to people off-Site via thermal radiation. Potential for domino effect, escalation to other areas on-Site and off-Site including COMAH installations. Escalation of the fire to other installations at the Port of Immingham could initiate emergency plans at those sites causing a significant disruption to critical facilities, along with potential harm to persons on those sites	Measures included in design to reduce the potential for a loss of containment include the following: - Engineering design of the facility by experienced, qualified personnel. - The specification, construction and installation of equipment and pipework to industry codes and standards. - The design of hydrogen vents will be in accordance with EIGA Doc 06/19 (Ref 22-36). This guidance includes a specification for height of the hydrogen vent stack outlet which should be either 7m above ground level or 3m above the top of the tank whichever is the greater for protection of the operating personnel and equipment. - Plant design and plant layout to keep hazardous substances as far as is practical from offsite receptors.	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		loss of containment via damage to assets. A release of hydrogen can ignite as a result of friction during discharge resulting in a fire. Lightning strike could ignite flammable gas/vapour released from vent stack or relief valve. Flammable gas which finds a source of ignition will result in a flash or jet fire.	and damage to their assets. Potential for direct harm to the environment from thermal radiation such as impact on flora and fauna near to Site. Also, harm to the environment via release of contaminated firewater to environmental receptors including the Humber Estuary. Emergency services are likely to advise local residents to close doors and windows and remain indoors for the duration of the event.	- HAZID and HAZOP studies carried out for the Project as described in **Section 22.8** to eliminate hazards where possible, determine requirements for protection and mitigation systems and identify hazards which require further assessment. - Engineering design risk assessments and QRA carried out to demonstrate ALARP as required by the COMAH Regulations (Ref 22-3). - Domino discussions with neighbouring COMAH facilities - Use of fully welded connections rather than flanged connections for gaseous systems. Flange guards are to be fitted as necessary where welding is not practical. - The Pressure Systems Safety Regulations 2000 (“PSSR”) (Ref 22-17) apply to equipment and pipework at the Site. Compliance with PSSR requires detailed scheduled inspection and testing to prevent a loss of containment. - Certification of equipment by notified bodies prior to use which demonstrate “fit for purpose” equipment.	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				- Control systems to be installed to continuously monitor process parameters including pressure and temperature. - Safety instrumented systems would be designed, operated and maintained in accordance with guidance documents BS 61508/11 (Ref 22-11,Ref 22-12) which is recognised as providing best practice. - Fire and gas detection and alarm systems would be in operation. - Passive and active fire suppression systems would be employed subject to risk assessments. - Although not generally considered flammable (due to narrow range of flammability) ammonia will be routed to a flare system for safe disposal in the event of a process upset. Natural gas systems will also be routed to a flare for safe disposal. - In the event of a process upset, hydrogen would be routed to a vent system for disposal. The vent system will be designed to safety vent hydrogen in accordance with EIGA 06/19 (Ref 22-36).	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				- All process areas of Site would be subject to hazardous area classification, to determine where mechanical and electrical equipment is to be certified in accordance with the Appareils destinés à être utilisés en ATmosphères EXplosives ("ATEX") Directive (Ref 22-18), to reduce the risk of an active source of ignition. This would be carried out as part of the programme of compliance with the DSEAR (Ref 22-9) at the Project. DSEAR implements both EU ATEX directives, the 'equipment directive' (Ref 22-18) and the 'workplace directive' (Ref 22-19) into UK Legislation. Currently, no changes are planned to these Regulations as a result of the UK leaving the EU. Determination of hazardous area classification will be in accordance with methodology provided by Energy Institute Model Code of Safe Practice Part 15 – Area Classification for Installations Handling Flammable Fluids (Ref 22-28). - Anhydrous ammonia would be stored and handled as a liquid in a	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				cold/refrigerated condition. This is inherently safer than storing, handling, and transporting as a compressed gas at ambient temperature and high pressure. The management and operational controls to reduce the potential for a loss of containment include the following: - Operation and management of the facility by experienced, qualified personnel. - Security systems to be deployed including cyber security. - Operability risk assessments carried out during design phase. - An SMS would be developed and in place prior to operation, incorporating Management of Change (“MoC”) procedures. - Planned preventative maintenance systems to prevent equipment defects and failures. - Inspection regimes to detect corrosion and other mechanisms which could lead to equipment defects.	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				- Emergency planning and response procedures including regular live tests. - A risk assessment in accordance with DSEAR (Ref 22-9) would be produced prior to operation including Hazardous Area Drawings. These drawing define areas where electrical and mechanical equipment is to be appropriately certified in accordance with the ATEX Directives (Ref 22-18,Ref 22-19).	
5	**Explosion/Energy release**	Significant loss of containment of ammonia, hydrogen or natural gas caused by accidental damage or failure of containment systems. Explosion could also be initiated via malicious damage/conflict/arson. Potential for incident at a neighbouring major hazard installation to escalate to Site via domino effect and vice versa.	Potential for significant harm to people on-Site, including fatal injuries and harm to people off-Site via explosion overpressure. Potential for damage off-Site such as broken glass, impact from projectiles. Potential for damage to critical assets e.g. overhead power transmission systems. Potential for domino effect, escalation to	The design and operating mitigation measures are the same as those defined for Risk Event 4, which is a major fire. Principally, these measures involve preventing a loss of containment by applying industry standards and best practice to the engineering design of the facilities which would be subject to rigorous safety assessments. These measures are a fundamental requirement for legislative compliance, without which the facility would not be permitted to operate. On Site occupied buildings will be designed to withstand explosion overpressures which will be determined using the Phast consequence modelling	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		If released gas accumulates and ignition is delayed, an explosion could occur. Degree of impact depends on release point and level of congestion within process structures on-Site.	other areas on-Site and off-Site including COMAH installations.	software and the Baker Strehlow Tang vapour cloud explosion model.	
6	**Release of toxic gas**	Significant loss of containment of ammonia gas from onshore facilities caused by accidental damage, failure of containment systems or malicious damage. Potential for incident at a neighbouring major hazard installation to escalate to and from site via domino effect. Material could be released as gas or rainout and/or dissolution in air to form ammonium hydroxide.	Potential for significant harm to people on-Site, including fatal injuries and harm to people off-Site via contact with ammonia. Emergency services are likely to advise local residents to close doors and windows and remain indoors for the duration of the event. Significant interruption to operations at Immingham Port and other key locations.	The principal design and operating mitigation measures are as those defined for Risk Event 4. In addition to these measures, a specific toxic gas detection system would be installed, with a corresponding emergency alarm and procedures. This would allow an early intervention by operators in the event of an accidental loss of containment of ammonia. The ammonia storage tank will incorporate secondary containment and will be designed to industry best practices to minimise the risk of ammonia release/ leakage, to include multiple redundance in pressure relief and instrumented protection systems.	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
			Potential for harm to the environment if material released to Humber Estuary.	Ammonia piping systems, including the ship offloading system will be designed to minimise risk of releases and severity of releases, including: - Minimise leak points - Use of two smaller ship offloading lines rather than single larger line - Use of emergency shutoff valves. Toxic gas detectors will be located at appropriate locations on the facility to enable early detection and alarm of any ammonia release. Safe havens will be located on Site and on or at the foot of the jetty, to allow operators to shelter in the event of an ammonia release. The design of these facilities will be informed by the output of modelling studies but will be expected to provide a minimum of 30 minutes protection. Active fire protection systems will be installed at the jetty, comprising water deluge and monitors, which are systems designed to apply high rates of water to extinguish fires and cool adjacent structures.	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
7	**Incident(s) associated with jetty and marine operations**	Various scenarios associated with marine and jetty operations including the potential for a release of environmentally harmful material to the Humber Estuary. These scenarios include the following: An accidental release of marine fuel oil or black/grey/ballast water from marine transport. Accidental damage to ammonia vessels such as collisions with jetty infrastructure, allisions with other vessels and incidents during berthing causing a loss of containment. Additional scenarios have been identified in the Jetty HAZID study,	Potential for significant harm to persons on board vessels, at jetties or other locations close to vessels. A release of flammable substances such as fuel oil leading to potential for fire if ignited, resulting in harm to people and the environment. If not ignited, material could form a plume on water restricting oxygen supplies to the marine environment. All substances listed have potential for harm to the water environment if material(s) released, via increase in Chemical and or Biological Oxygen Demand (COD/BOD) levels.	Measures included in design to reduce the potential for a loss of containment to the marine environment include the following: - The fuel systems onboard ships would be designed to the appropriate maritime engineering standards. These would include the technical integrity of the fuel storage systems, leakage detection and spill containment. - Fuel leaks would be readily detected by devices such as flow and pressure indicators and isolated (using isolation valves etc.) to minimise the loss of material to secondary containment. - Onshore facilities at the Port are to be used for the treatment and disposal of ballast/grey/black water. This material would not be discharged to the Humber Estuary. - The design and operation of the VLGC would incorporate safety features, primarily the robust design of the ship and cargo tanks, which typically incorporate a double-hull construction. - Lloyds Register publish a list of standards to be adopted for the ammonia transport ships, contained in	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		which are contained in **Table 22-6.**		'The Rules and Regulations for the Construction and Classification of Ships for the Carriage of Liquefied Gases in Bulk', published July 2022 (Ref 22-20). - Control systems including Emergency Shutdown ("ESD") systems, would be designed, and installed according to engineering design standards, such as those published by International Electrotechnical Commission ("IEC"). These systems minimise the potential for human error and mitigate the consequences, should an error be made, by a fast, safe shutdown of the transfer systems. - In the event of a fire onboard vessels or at the jetty, a protected route along the jetty will be provided to allow people to reach a place of safety. This is typically onshore at the base of the jetty. - The jetty will be designed to include the capability for emergency services to access all areas. - In the event of a fire onboard vessels, the coastguard can deploy firefighting measures, as required for compliance with best practice contained in HSG	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				186, which is guidance provided by the HSE on the bulk transfer of dangerous liquids and gases between ship and shore (Ref 22-37). The management and operational controls to reduce the potential for a loss of containment include the following: - An oil spillage plan would be produced prior to operation as required by the International Convention for the Prevention of Pollution from Ships ("MARPOL") Annex 1, Regulations for the Prevention of Pollution by Oil, Regulation 26 (Ref 22-21) The MARPOL convention is enacted in the UK via The Merchant Shipping (Prevention of Oil Pollution) Regulations 2019 (Ref 22-22). - The Project will comply with applicable responsibilities for marine safety which are established in the Port Safety Marine Code and the associated Guide to Good Practice which are published by the Department for Transport ("DfT") and Maritime and Coastguard Agency (Ref 22-26). A NRA and Navigational Simulation Study have been developed for the Project by a	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				consultant specialising in marine and transportation safety (Anatec Ltd). These assessments of navigational risks incorporate simulations and analysis of marine traffic movements to identify potential hazards. The NRA has been carried out in accordance with the methodology contained in IMO Guidelines for Formal Safety Assessment (Ref 22-27). Consultation with stakeholders including the Port operator has been carried out during a navigational hazard review workshop. The results of the NRA are described in detail in **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**. Prior to operation, an ERA would be produced for the Project which will use best practice such as the CDOIF methodology described in **Table 22-2**. This assessment would determine the sufficiency of protection measures in the event of a scenario such as a release to the marine environment and conclude if risks are within the tolerable category. Further mitigation measures are listed in **Table 22-6**	

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
8	**Release during road transport off-site**	Collisions/accidents involving road tankers containing hydrogen causing loss of containment, leading to fire and/or explosion.	Potential for significant harm to persons within and near to vehicle including potential fatalities. Significant interruption to road traffic, requiring intervention by emergency services.	The design, construction, operation, maintenance and repair of road vehicles for the transport of hydrogen would be in accordance with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (Ref 22-23) and ADR. Vehicles containing hydrogen would be driven by ADR trained drivers only. Training and management of these drivers would be in accordance with this legislation and supported by advice from a dangerous goods safety advisor.	**Yes**
9	**Decommissioning Activities – Dismantling Vessels and Pipework**	An incident occurring during decommissioning such as dismantling pipework where vessels have not been fully de-inventoried or isolated (still contain flammable material). Potential for fire and/or explosion. Failure to isolate services such as electrical cabling during these activities could	Potential for significant harm to persons on-Site carrying out activities, including potentially fatal injuries. Due to quantities involved which would be less than normal operation, no impact would be expected off-Site.	At the end of the operational life of the Project, there are a number of factors which must be considered to safely carry out the decontamination, decommissioning and disposal of process equipment and pipework which has contained the dangerous substances. These include ensuring systems are ‘gas-free’ via the removal of the inventory, venting systems to atmosphere and ensuring they are sufficiently clean so no remaining gas can be detected. Comprehensive plans for decommissioning safety and environmental management would be developed prior to work	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		also result in harm to human health, such as electrocution.		commencing, to risk assess tasks and produce method statements for the work. This would be required as part of the COMAH Safety Report and to ensure compliance with the Environmental Permit. All decommissioning work to be controlled via permit to work systems as part of the required Safety Management System. Isolation procedures such as 'Lock-out/Tag-Out' are standard industrial practice for the isolation of electrical systems on process and manufacturing sites.	
10	**Storms / Flooding / Climate Change**	Potential for pluvial and fluvial flooding to cause asset damage leading to loss of containment of substances, consequences considered above within Risk Events 4, 5 and 6. Lightning strike during storm has potential to cause ignition of highly flammable gas. Potential for the frequency and severity	Potential for significant harm to persons on Site in the event of a loss of containment via fire/ explosion/toxic release. Potential for harm to people off-Site in the event of a major release. Potential harm to the environment e.g. via release of contaminated flood water.	The Flood Risk Assessments (**Appendix 18A [TR030008/APP/6.4]**) has been undertaken out to inform the addition of flood protection measures, if required. Climate change resilience is a consideration under the COMAH Regulations (Ref 22-3) e.g. flooding as a consequence of climate change is considered as an initiating event for a major accident hazard. Design and construction of drainage systems in accordance with civil engineering codes and standards to withstand storm events.	**Yes**

Risk Event	Risk Event Description	Summary Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		of consequences of storm events could increase as a result of climate change.		Engineering design of jetty and other systems to allow for potential increase in tidal range and potential climate change impacts.	

22.9.6 In **Table 22-6**, ammonia is considered as it is the substance with the most significant potential consequences.

22.9.7 CO_2 is not a prescribed substance under COMAH Regulations but was assessed in the accident scenarios as it has hazard potential. The risks to individuals and the marine environment from accidental CO_2 releases at the jetty individually and in combination with ammonia have been assessed and ALARP measures and emergency planning for accident scenarios involving both CO_2 and ammonia on the jetty are no more onerous than those for ammonia in isolation.

Table 22-6: Detailed Assessment of Risk Event 7 – Marine Environment MA&D Scenarios

Risk Event	Risk Event Description	Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
7.1	Accidental release of ammonia e.g. from loading arm coupling or other pipework flange or connection.	The coupling is installed or disconnected incorrectly (gasket, or O ring type), resulting in a release of ammonia	Two-phase (liquid and vapour) ammonia release, risk to ship crew and Jetty Operators Release into the river channel area Potential for significant harm to people and the environment	Marine loading coupling design, selection and installation Technician training in connecting and disconnecting coupling Shut off valves to minimise product releases Emergency stop manually activated push button at local panel Jetty Operator present at jetty head for initial loading period and final loading period plus periodic monitoring Deluge monitors available to suppress the cloud of ammonia vapour Safe Haven containing Self-Contained Breathing Apparatus (“SCBA”) Emergency Escape Breathing Apparatus (“EEBA”)	**Yes**

Risk Event	Risk Event Description	Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				Gas detection systems to alarm and alert Jetty Operators and ship crew to release	
7.2	Vessel tow away due to excessive movement of the vessel, damage to loading equipment and potential release of ammonia	The ship once moored will constantly move upwards/downwards with the rise and fall of the estuary levels. If the ship moves outside design limits the ship can tow away the Marine Loading Arm	Release of ammonia refrigerated liquid and formation of a vapour cloud Potential for significant harm to people and the environment Damage to assets including the loading arm and jetty structure	Marine Loading Arm design features include a monitoring and trip system that will sense the ships movement and shut the loading valves if excessive movement is detected A breakaway coupling will separate the loading arm from the ship and seal both open ends of the pipework Safe Haven containing SCBA and EEBA Development of appropriate interface protocols between operations staff, vessel master, and harbour authority, all to be set out in the jetty operations manual	**Yes**
7.3	Vehicle collision with piping or equipment located on the jetty, impact damage and potential release of ammonia	Vehicle(s) driving along the jetty pier section (approx.1250m length) which strikes equipment/ pipework causing release of ammonia	Damage to piping and/ or equipment potentially causing a release of ammonia resulting in toxic vapour release and/or fire Potential for significant harm to people and the environment	Physical separation of the piping and equipment from the vehicle movements Lighting provided along the Jetty Vehicular access with consideration to pull off areas Control of maintenance vehicles to prevent unauthorized access Security access gate and warning lights when loading or Offloading is in operations	**Yes**

Risk Event	Risk Event Description	Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				Shut off valves to minimise product releases in the event of damage	
7.4	Electrical static shock from mooring ropes	When mooring the ship and tying off to the mooring equipment located on the Jetty Head Platform and Mooring and Breasting Dolphins, significant static electricity can build up into the mooring ropes from friction	Static electrical shock with potential for harm to people present Static discharge presents a source of ignition if accompanied by a release of flammable substances	Correct specification of insulated (non-conductive) mooring ropes Procedure for tying off mooring ropes Risk assessment for operation to incorporate awareness of potential static discharge	**Yes**
7.5	Accidental release of ammonia which effects personnel during ship navigation	Release of ammonia caused by failure or accidental damage to containment systems Ammonia vapour reaches personnel located on adjacent or passing vessels	Injury to ship crew and/or loss of control effecting passing vessels due to adverse effects of ammonia leak	Design and construction of ammonia containment systems on board vessel to prevent accidental releases Gas detection and alarms to alert crew Further risk assessment required as part of the COMAH Safety Report including modelling to be carried out to ensure risks are reduced to ALARP	**Details of the final mitigation to be confirmed following the additional risk assessments referred to.**
refer7.6	Accidental release of ammonia which ignites resulting in fire	Release of ammonia caused by failure or accidental damage to containment systems	Injury to ship crew and/or loss of control effecting passing vessels due to fire Damage to vessels	As 7.5 Further risk assessment required as part of the COMAH Safety Report including modelling to be carried out to ensure risks are reduced to ALARP	**Details of the final mitigation to be confirmed following the additional risk**

Risk Event	Risk Event Description	Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
		Ammonia vapour ignites resulting in a fire causing harm to people and damage to vessel			**assessments referred to.**
7.7	Mooring line snapback (Incident in which a mooring line under tension can become free and release sufficient energy to harm persons present)	Workers in mooring area enter snap back zone and are injured due to snap back from mooring line	Risk to operations staff and vessels crew due to line parting	Provision of load monitoring equipment on Quick Release Hook ("QRH") Determination of appropriate staffing and communications interface/protocols between jetty control/vessel master and berth operations staff, to be documented in jetty operating manual Proper consideration using AQP during design, and identification of danger zones with associated operational restrictions as needed	**Yes**
7.8	Risk of drowning associated with workers present on vessels and within Jetty area	Individual falls from ship, gantry or jetty as a result of accident, loss of footing etc Loading /offloading period will encompass all types of weather and daylight conditions	Potential for harm to people if the enter water accidentally including potential for fatal drowning	Jetty to have access point(s) that person overboard can swim to and climb from Sufficient PPE, flotation suit devices available to deploy in an emergency Emergency alarm to call for Emergency Services Emergency procedures and training Sufficient lighting Two man operating team no lone working	**Yes**

Risk Event	Risk Event Description	Description of Risk Event	Risks and Consequences before Additional Mitigation	Additional Mitigation Measures	Mitigated to ALARP?
				Warning lines near jetty edge Provision of safety equipment	
7.9	Mariners leaving the vessel without obtaining authorisation	Potential for mariners to leave the ship for various reasons including sickness or leave	Unauthorised permission to leave the vessel	Procedure to hold and process individuals. Contact Customs person for passport processing. Sickness requiring ambulance access to jetty head. Mariners hold a special passport /identification. Dock operating plan	**Yes**

Design Safety Studies

22.9.8 Further to the additional mitigation measures relating to the defined risk events presented in **Table 22-5**, design safety studies are being undertaken as required pursuant to the COMAH Regulations.

22.9.9 The design safety studies are an essential part of the engineering design development of the Project from the initial conceptual stage, throughout the operational lifetime and eventual decommissioning and demolition of the facility. The design safety studies such as HAZID and HAZOP typically involve a multidisciplinary project team, consisting of engineers, scientists and other specialists, facilitated by experienced technical safety study leaders. Where computer modelling is used, these studies are carried out by technical safety specialists on behalf of the project team.

22.9.10 The number and complexity of these studies is such that it is only practical to include an overview of the intent and outcome of key studies; however, the output of these studies has been, and will continue to be, communicated at the appropriate time with the relevant stakeholders including the regulatory authorities and statutory consultees.

22.9.11 A standard methodology is employed for these assessments, which has been applied for many years throughout the process industries. This methodology includes:

a. Concept Risk Review

   i A concept risk review is typically undertaken at a very early stage in the project development to review the proposed location and fundamental design and intent of the facility to identify and eliminate significant hazards. The Project engaged a third party specialist to conduct this review, which identified a number of opportunities to reduce risk. This study incorporated consequence analysis in which computer modelling software is used to determine the severity and extent of hazardous events, such as a fire or release of toxic gas.

b. A separate consequence analysis study has been carried out on the risks of an explosion following an accidental release of flammable gas. The purpose of this study was to assess explosion overpressure levels to inform the site layout and specification of buildings. This study has also been carried out by a third party using specialist software and will be regularly reviewed and updated as the Project engineering design is progressed.

c. Further consequence analysis studies will be carried out and the output will be included within the COMAH Safety Report for the Project.

d. Field experiments have been commissioned by Air Products at a site in the UK to study two-phase (gas and liquid) releases of refrigerated ammonia to land and water across a range of weather conditions. The purpose of these experiments was to obtain a greater degree of accuracy in the terms used to model such releases, therefore achieve a high level of confidence in the results generated by computer modelling. The results of these experiments

have been published in the journal Process Safety Progress, March 2023 (Ref 22-29).

e. Site Layout Review

   i The arrangement of process units and services is an important factor in risk management for facilities such as the Project, therefore a site layout review is typically carried out at the concept stage to interrogate the proposed layout and ensure inherent safety measures are incorporated such as spacing and segregation of systems and to inform the DNV study on potential land use planning zones.

   ii A general layout review has been carried out for the Project and more detailed reviews completed for sections of the Site including the Hydrogen Liquefiers and hydrogen production units. Further layout reviews are planned throughout the engineering design phase to assess all areas in detail.

   iii The methodology used for the layout review incorporates industry guidance on separation distances for equipment items such as the liquid hydrogen storage tank and gaseous hydrogen pipework published by the National Fire Protection Association (“NFPA”).

f. HAZID Studies

   i HAZID studies are typically carried out during a FEED stage of projects to identify a wide range of potential hazards using a structured guideword based methodology.

   ii A HAZID was carried out for the Jetty facilities in May 2023 which identified a total of nine (9) specific risk events. The output of this study is summarised in **Table 22-6.**

g. Further HAZID studies are planned for the Project and will be carried out at the appropriate juncture in order to meet legislative requirements.

h. HAZOP Studies

   i Air Products has designed and operated a number of hydrogen facilities worldwide for many years which rely on processes identical to that proposed for the Project. Extensive HAZOP studies have been carried out previously on these systems including the hydrogen liquefier, hydrogen storage and hydrogen production units. These studies have helped to optimise the design, improving safety and operability and therefore will be used as a basis for HAZOP studies to be carried out for the Project. The Applicant’s project team will review and update these studies at the appropriate stage in the design process, so they incorporate any specific elements associated with installation of the equipment at the Project.

i. Hazardous Area Classification Studies

i A preliminary hazardous area classification study has been carried out for the Project in accordance with industry standard guidance published in the Energy Institute Model Code of Safe Practice Part 15. The purpose of this study is to identify areas of the installation in which there is the potential for an explosive atmosphere to be present during the expected operational activities. These areas typically include emergency vents from storage vessels and fugitive emissions from flanges and pipework connections containing flammable substances. Once identified, these potential sources can be either eliminated or controlled. The extent of the potentially explosive area is then quantified and sources of ignition such as electrical and mechanical equipment can be appropriately controlled. Equipment which is required to operate in areas where there is a risk of potentially explosive atmospheres is appropriated specified to reduce the risk of ignition.

ii The hazardous area classification assessment is a fundamental requirement for safety and compliance with DSEAR (Ref 22-9). This assessment and the corresponding drawings produced by specialist safety engineers showing the location and extent of these areas, will be subject to continuous review and update throughout the operational life of the Project.

j. Fire Protection Studies

i Preliminary fire protection studies have been carried out for the Project. These studies comprise a number of key assessments which are:

- Segregation of the installation into discrete fire zones. The purpose of segregation is in an emergency, this helps to prevent the spread of a fire from one area of the facility to another.
- Design of the active fire suppression for the installation. This includes a fire water storage and distribution system, designed in accordance with industry standard guidance such as Energy Institute model code of safe practice part 19 (Ref 22-30).

k. Functional Safety Studies

i Functional safety is the term used to establish and verify the safety of instrumented systems used to fulfil important safety functions such as automatic high pressure and high temperature trip systems installed in process equipment. These systems use sensors to detect parameters such as pressure and temperature, with signals routed to computers whose software compares the observed conditions with set points. If the process conditions are observed to be deviating from these set points, a software signal will be sent to devices such as valves which will open or close in response to return the process conditions to the set point.

ii These systems are subject to formal process safety analysis to establish their required reliability, that is, how important it is that they operate as designed when needed. Once the reliability has been established, the safety loop comprising of sensor, software and operating element (valve) is validated to ensure that it can achieve the design reliability.

l. Industry standard methodology is used to establish the required reliability, which is provided in the standards BS EN IEC 61508 (Ref 22-31) and 61511 (Ref 22-32), which is the standard developed for process industries such as the Project.

22.10 Assessment of Residual Effects

Construction

22.10.1 The potential risk events during Project construction activities have been identified and assessed in **Table 22-4** and **Table 22-5.** Where risks cannot be eliminated, they would be reduced to ALARP, and the residual risks associated with construction hazards managed via the controls listed in **Table 22-5**. The controls and mitigation measures are primarily compliance with the CDM Regulations (Ref 22-8) and the development and use of a comprehensive CEMP.

22.10.2 A COMAH pre-construction Safety Report will be submitted for review by the competent authority prior to Project construction. The purpose of this report is to demonstrate to the competent authority that all measures necessary to manage risk have been taken.

Operation

22.10.3 The presence of toxic and flammable gases during Project operation means that their associated hazards cannot be entirely eliminated, but must be managed to reduce risks to ALARP, in accordance with the HSE's requirements under the COMAH Regulations (Ref 22-3). Risk reduction and mitigation is secured via compliance with all applicable UK legislation and permits including the terms of the Safety Report required by the COMAH Regulations and the Environmental Permit (which will set out the standards and guidance that the operation of hydrogen production facility will need to comply with).

22.10.4 **Paragraphs 22.10.5** to **22.10.9** set out actions that will be taken in order to meet the requirements of the COMAH Regulations and the EPR (in addition to other legislative requirements relevant to the hydrogen production facility).

22.10.5 Continuous process monitoring systems will be provided in the Project control room, such as Supervisory Control and Data Acquisition ("SCADA"). These systems comprise of computer hardware and software connected to the process systems which observe operational conditions such as temperature and pressure, providing real time data to process operators, data logging and trending analysis. SCADA provides a means of automating process operations reducing the requirement for manual interventions and therefore the potential for human error.

22.10.6 COMAH establishments such as the Project are required to adhere to good practice in all aspects of operation which includes inspection and planned preventive maintenance. These processes are a key aspect of demonstrating the integrity of plant and equipment and will be carried out to prevent failures and identify defects such as corrosion. These procedures will form part of the Safety Management System for the Project, to ensure it operates safely and efficiently.

22.10.7 All personnel associated with the operation of the Project facilities would be subject to rigorous standards of training and competency assurance, including process operators, vessel and jetty personnel and road tanker drivers.

22.10.8 The proposed operation of the Site and the on and off site emergency plans would be subject to rigorous appraisal by the COMAH competent authority and other stakeholders. The operator of the facility would be required to notify the competent authority prior to operation and submit the COMAH Safety Report for review. The competent authority would authorise Site operations through review and assessment of the COMAH Safety Report.

22.10.9 When operational, the Site would form part of a COMAH cluster. The purpose of these groups is to share information and provide a cooperative, collaborative forum for operators of COMAH sites. The information shared includes the hazards which are present on each site and emergency response plans. Humberside is one of the main clusters in the UK, with sites working together to share information with local residents and people working near the sites as well as with the competent authority and local authorities.

Decommissioning of the hydrogen production facility

22.10.10 Process substances present at the facility are primarily flammable gases, therefore risks would be reduced to ALARP during decommissioning via controls such as the use of equipment including electrical tools. Prior to dismantling equipment and pipework, the contents would be safely vented to ensure no flammable or toxic materials remain and portable gas detectors would be used to confirm a ‘gas-free’ status prior to commencement of work. These requirements would need to be met in order to comply with the terms of the Environmental Permit (which will require a decommissioning plan to be agreed with the Environment Agency).

22.11 Summary of Assessment

22.11.1 The purpose of this chapter is to present an assessment to identify and describe the potential, credible MA&D scenarios which could be pertinent to the Project. The Project is defined within **Chapter 2: The Project [TR030008/APP/6.2]** and comprises a jetty in the Humber Estuary to be used for the import and export of liquid bulk products and a landside facility to store and convert ammonia to hydrogen which will be liquified and transported off site for use.

22.11.2 A total of 15 potential hazardous scenarios were initially identified, of which ten were considered credible and therefore termed Risk Events, requiring further assessment. These Risk Events include incidents such as fire and/or explosion caused by a major loss of containment of flammable and toxic gases.

22.11.3 Potential Risk Events have been identified during construction, operation and decommissioning phases of the Project.

22.11.4 The consequences of Risk Events identified are primarily harm caused to people present on-site. This is as a result of an exposure to thermal radiation generated by fire, exposure to explosion overpressure, impact with missiles generated by an explosion such as glass fragments and exposure to toxic ammonia gas. The harm caused by these events can include the potential for fatal injuries, corresponding to the criteria for a MA&D established in **Paragraph 22.4.8**.

22.11.5 There are potentially harmful consequences to the environment as a result of the identified Risk Events. These include direct harm from thermal radiation to flora and fauna in and around the Humber Estuary caused by a major fire. A release of harmful substances such as MFO from vessels transporting ammonia to Site could also cause harm which could potentially correspond to the criteria established in **Paragraph 22.1.2**, which is long term damage to 0.5 ha of the river.

22.11.6 Given the inherent properties of Hydrogen and Ammonia, it is not possible to eliminate risks entirely. Risk must therefore be managed by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to achieve a level ALARP, as required by the COMAH Regulations (Ref 22-3).

22.11.7 The Project would comply with all relevant safety and environmental legislation for the management of risks on industrial facilities, from the design and construction phase, through operation and eventual decommissioning.

22.11.8 Further analysis of the risks to the health and safety of people (on-site and off-site) and to the environment will be carried out throughout the lifecycle of the Project from design through operation to eventual decommissioning. A number of these process safety studies have already been carried out to inform the design process and identify mitigation and control measures to reduce the risk of major accidents.

22.11.9 A description of the risk assessments carried out to date has been incorporated within **Section 22.8**, however further safety studies will be ongoing and the output and conclusions of these will be shared with stakeholders including the regulatory authorities.

22.12 References

Ref 22-1 HMSO (1974). Health and Safety at Work etc. Act 1974.

Ref 22-2 IEMA (2020). Major Accidents and Disasters in EIA: A Primer.

Ref 22-3 HMSO (2015). The Control of Major Accident Hazard (COMAH) Regulations 2015.

Ref 22-4 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 SI 572.

Ref 22-5 HMSO (2012). Directive of the European Parliament and Council, 4th July 2012 on the control of major accident hazards involving dangerous substances (2012/18/EU) (the 'Seveso III' Directive).

Ref 22-6 HMSO (2000). The Pipelines Safety Regulations 2000.

Ref 22-7 HMSO (2015). The Planning (Hazardous Substances) Regulations 2015.

Ref 22-8 HMSO (2015). The Construction (Design and Management) Regulations 2015.

Ref 22-9 HMSO (2002). The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR).

Ref 22-10 CDOIF (2016). Chemical and Downstream Oil Industries Forum Guideline V2.0.

Ref 22-11 British Standards (2010). BS EN 61508-1 Functional safety of electrical/electronic/ programmable electronic safety-related systems. General requirements.

Ref 22-12 British Standards (2017). BS EN 61511 - Functional safety. Safety instrumented systems for the process industry sector (multi-part document).

Ref 22-13 HMSO (2015). The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015.

Ref 22-14 Reuters (2016). Malaysia's Petronas Chemicals says 2 killed from ammonia leak at plant.

Ref 22-15 CBC (2015). Ammonia leak at Medicine Hat nitrogen plant kills worker.

Ref 22-16 Chemical and Engineering News (2019). Hydrogen blast led to deaths at US silicones plant.

Ref 22-17 HMSO (2000). The Pressure Systems Safety Regulations 2000.

Ref 22-18 Official Journal of the European Union (2014). Directive 2014/34/EU - Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX 114 "equipment" Directive).

Ref 22-19 Official Journal of the European Union (1999). Directive 1999/92/EC - Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres (ATEX 153 "workplace" directive).

Ref 22-20 Lloyds Register (2022). The Rules and Regulations for the Construction and Classification of Ships for the Carriage of Liquefied Gases in Bulk.

Ref 22-21 International Maritime Organisation (1973). International Convention for the Prevention of Pollution from Ships (MARPOL) Adoption: 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II).

Ref 22-22 HMSO (2019). The Merchant Shipping (Prevention of Oil Pollution) Regulations.

Ref 22-23 HMSO (2009). The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009.

Ref 22-24 HMSO (2016). The Environmental Permitting Regulations (2016).

Ref 22-25 Health and Safety Executive (HSE). HSE's Land Use Planning Methodology.

Ref 22-26 Department for Transport (2016) Port Safety Marine Code - for all UK Harbour Authorities and other marine facilities, berths and terminals.

Ref 22-27 International Maritime Organisation (2002). Guidelines for Formal Safety Assessment.

Ref 22-28 Energy Institute Model Code of Safe Practice Part 15, Area Classification for Installations Handling Flammable Fluids 4th Edition 2015.

Ref 22-29 Process Safety Progress March 2023 Red Squirrel Tests: Air Products' ammonia field experiments

Ref 22-30 Energy Institute model code of safe practice part 19: Fire precautions at petroleum refineries and bulk storage installations 4th Edition 2023.

Ref 22-31 BS EN IEC 61508-2:2010 Functional safety of electrical/electronic/ programmable electronic safety-related systems - Requirements for electrical/electronic/ programmable electronic safety-related systems. June 2010.

Ref 22-32 BS EN IEC 61511 (multi-part series) Functional safety. Safety instrumented systems for the process industry sector.

Ref 22-33 American Petroleum Institute (API) 625 Tank Systems for Refrigerated Liquefied Gas Storage 1st Edition 2010.

Ref 22-34 API 520 Part I, 10th Edition, Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries

Ref 22-35 API 521 Pressure-Relieving and Depressurizing Systems, provides guidance, recommendations, and alternatives for the design of pressure-relieving and vapor de-pressuring systems at liquefied natural gas terminals, petrochemical facilities, gas plants, and other petroleum production facilities.

Ref 22-36 European Industrial Gases Association (EIGA) document reference 06/18, Safety in Storage Handling and Distribution of Liquid Hydrogen.

Ref 22-37 HSE. HSG 186, The bulk transfer of dangerous liquids and gases between ship and shore.

Ref 22-38 The Stationery Office Limited. (2011) The Railways and Other Guided Transport (Safety) (Amendment) Regulations.

Ref 22-39 The Stationery Office Limited. (1995) Merchant Shipping Act.

Ref 22-40 The Stationery Office Limited. (1987) Pilotage Act.

Ref 22-41 Health and Safety Executive. (2014) Safety in Dock Approved Code of Practice (ACOP) and Guidance.

Ref 22-42 The Stationery Office Limited. (2008) The Planning Act.

Ref 22-43 Department for Transport (2012). The National Planning Policy Statement for Ports.

Ref 22-44 Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework.

Ref 22-45 Ministry of Housing, Communities and Local Government (2019). Planning Practice Guidance – Hazardous Substances.

Ref 22-46 Ministry of Housing, Communities and Local Government (2022). Planning Practice Guidance – Flood Risk and Coastal Change.

Ref 22-47 Ministry of Housing, Communities and Local Government (2019). Planning Practice Guidance – Climate Change.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 23: Socio-economics

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 23: Socio-economics

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

23 Socio-economics

23.1 Introduction

23.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on socio-economics. This includes considering potential impacts on the following receptors:

a. Employment and the local community;

b. Users of recreational routes and Public Rights of Way ("PRoW"); and

c. Private/public assets (including residential properties, development land, local businesses, community facilities).

23.1.2 This chapter interacts with the following chapters **[TR030008/APP/6.2]**:

a. **Chapter 2: The Project**

b. **Chapter 4: Legislative and Consenting Framework**

c. **Chapter 7: Noise and Vibration**

d. **Chapter 11: Traffic and Transport**

e. **Chapter 13: Landscape and Visual Impact;**

f. **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk & Drainage**

g. **Chapter 21: Ground Conditions and Land Quality**

h. **Chapter 22: Major Accidents and Disasters**

i. **Chapter 24: Human Health and Wellbeing**

j. **Chapter 25: Cumulative and In-Combination effects**

23.1.3 This chapter is supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 23-1: Socio Economic Receptors within the Site Boundary**

b. **Figure 23-2: Socio Economic Receptors within 500m of the Site Boundary**

c. **Figure 23-3: Socio Economic Receptors within 5km of the Site Boundary**

d. **Figure 23-4: Lower Super Output Area**

e. **Figure 23-5: North East Lincolnshire Local Authority Area**

f. **Figure 23-6: Access to the Sea Wall**

23.2 Consultation and Engagement

23.2.1 A scoping exercise was undertaken in August 2022 and the Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the exercise. This details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the

Project on socio-economics. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 (**Appendix 1.B [TR030008/APP/6.4]**).

23.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the *Planning Act 2008* (the "2008 Act") (Ref. 23-33). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

23.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through analysis of the ongoing design-development, a series of changes to the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the *2008 Act* and a PEI Report Addendum was publicised to support the consultation.

23.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion is shown in **Appendix 1.C [TR030008/APP/6.4]**. Comments made in response to the formal consultation and other pre-application engagement are summarised in **Table 23-1**. The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 23-1 Consultation Summary Table (TR030008/APP/5.1):

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
Scoping Report August 2022	Planning Inspectorate	Analysis of tourism receptors: The Scoping Report seeks to scope out this matter as there are no tourism receptors in proximity to the Project, therefore it is unlikely there would be any impact experienced by tourists. Given the location of the development the absence of sensitive tourism receptors (other than the England Coast Path which is being assessed separately) the Inspectorate agrees that it is unlikely that significant effects on tourism would arise and this matter can be scoped out of the assessment on this basis.	Noted.
		Analysis of PRoWs (during operational phase): Two PRoWs are in proximity to the Project and it is proposed to scope this out of the assessment as user experience during operation would be as it is currently. The Inspectorate agrees that this matter can be scoped out on this basis.	Noted.
		Production of supporting Figures: The Scoping Report states that the ES would include a figure to denote the relevant study areas. This should include the relevant Lower Layer Super Output Areas ("LSOA[1]s") and the Grimsby travel to work area ("TTWA") in relation to the Project. Residential and business properties on Queens Road within the Project order limits should be clearly identified in any figures to help residents and businesses to identify likely impacts.	Detailed figures to support this assessment have been produced (**Figures 23-1**, **23-2**, **23-3** and **23-4**, **23-5** and **23-6 [TR030008/APP/6.3]**), identifying the relevant study areas as well as identifying the potentially affected receptors on Queens Road and along the coast. A full assessment of the potential impacts

[1] Lower Super Output Areas (LSOAs) areas are made up of groups of Output Areas, usually four or five. They comprise between 400 and 1,200 households and usually have a resident population between 1,000 and 3,000 persons. The 2021 Census reported 33,755 LSOAs in England (Ref. 23-23).

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			on all socio-economic receptors has been undertaken and reported in **Section 23.8**.
		Consideration of Census data: The Applicant refers to 2011 Census data and the Inspectorate notes that the 2021 Census data is now made available through the Office for National Statistics. As the Development Consent Order ("DCO") application will be submitted after the release of the 2021 Census data, this data should be used to inform the Socio-economic assessment.	2021 Census data has been reviewed and presented to provide an analytical review of the most recently available data at local, regional and national geographies (see **Section 23.6**). Census 2011 data is presented in a limited number of instances reflecting where Census 2021 data has yet to be published. In all these instances, such data has been included to provide context and is not directly used within the assessment of effects.
		Consideration of local housing availability: The Scoping Report proposes to assess the impact of a changing influx of workers, however it does not explicitly refer to effects on housing availability and effects on social cohesion in this chapter. The Inspectorate notes these matters are referenced under the chapter on health and well-being (para 23.4.3 of the Scoping Report). The assessment in the Environmental Statement ("ES") should consider if any likely significant effects would arise from the influx of construction workers on the local housing and rental market. This should cross-refer to the other relevant sections of the ES such as the assessment of health and well-being.	An analysis of the baseline conditions (**Section 23.6**) and potential impacts during construction (**Section 23.8**) has considered the extent to which the local private rented sector can accommodate the influx of temporary construction workers within the local area. The impact of this additional workforce on primary healthcare has also been considered (**Section 23.8**). Impacts upon Social Cohesion in respect of the perception of risk and community severance have been assessed and are reported within

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2].
	Immingham Town Council	<u>Consideration of the impact on local Private Assets:</u> Residents and businesses are rightly concerned about the potential Compulsory Purchase of their properties and land. Resulting in loss of jobs and homes. If they are not included, as some maps indicate they need to be informed to ease their minds. If they are included it seems unnecessary as there is so much other land on the development that consideration should be given to leaving them alone.	An analysis of the potential impact on Private/public Assets has been provided within **Section 23.8**. This has included analysis of the impact upon residential properties, business premises, community facilities and development land during construction, operation and the decommissioning phases.
	UK Health Security Agency/Office for Health Improvement and Disparities	<u>Consideration of local housing availability:</u> The scoping report does not identify the projected numbers of construction workers required for the scheme but does scope in potential social impacts from their presence. The presence of significant numbers of workers could foreseeably have an impact on the local availability of affordable housing, particularly that of short-term tenancies and affordable homes for certain communities. The cumulative impact assessment will need to consider this across the wider study area given the existing plans for Immingham and the number of other large schemes proposed within the region. Access to accommodation for residents with the least capacity to respond to change, for example, where there may be an overlap between construction workers seeking accommodation in the private rented sector, and people in receipt of housing benefit / low paid employment seeking the same lower-cost accommodation, should be considered. It should be noted the Housing Needs Assessment for North-East Lincolnshire Council (2019) identifies the private rented sector makes a significant contribution to meeting affordable housing needs. There are a number of infrastructure schemes proposed for the wider	An analysis of the baseline conditions presented in **Section 23.6** and potential impacts during construction in **Section 23.8** has considered the extent to which the local private rented sector can accommodate the influx of temporary construction workers within the local area. The impact of this additional workforce on primary healthcare has also been considered, see **Section 23.8**. Cumulative effects arising from construction employment generation and from the consequent changing influx of workers in respect of accommodation have been assessed and are presented in **Chapter 25:**

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
		region, increasing the potential for non-home-based construction workers to be seeking accommodation.	**Cumulative and In-Combination Effects [TR030008/APP/6.2]**.
		<u>Consideration of the local impact of the construction workforce:</u> The peak numbers of construction workers and non-home-based workers should be established and a proportionate assessment undertaken on the impacts for housing availability and affordability and impacts on any local services. Any cumulative impact assessment should consider the impact on demand for housing by construction workers and the likely numbers of non-home-based workers required across all schemes.	An analysis of the baseline conditions (**Section 23.6**) and potential impacts during construction (**Section 23.8**) has considered the extent to which the local private rented sector can accommodate the influx of temporary construction workers within the local area. The impact of this additional workforce on primary healthcare provision has also been considered in **Section 23.8**.
Statutory Consultation January 2022	Anglian Water	Given the fortuitous timing of the WRMP and DWMP and supporting SEA, the project could consider the new baseline and future position up to 2050 in the project EIA including HRA and other assessments. The impact of curtailed water supply to domestic customers could also be assessed including consideration of the Socio-Economic effects of the use of water for the project in the context of growth and climate change as well as the potential impacts on communities and business.	The only requirement for potable supply would be for offices (including fire sprinkler systems), welfare facilities and site safety showers. A non-potable supply is required in connection with the operational processes of the hydrogen production facility including for cooling purposes as well as fire water for emergencies. Anglian Water has made a commercial offer to provide the total non-potable water supply requirements for the Project (Phases 1 – 6). The proposed supply would have been considered by Anglian Water as part of their Water Resources Management Planning

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			(WRMP24) process. Further details of the overall water use of the Project are set out in **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk & Drainage [TR030008/APP/6.2]**. On that basis, there is likely to be no socio-economic effects on local communities and businesses.
	North East Lincolnshire Council	The development presents a significant investment into the port of Immingham. This will in turn secure numerous jobs in direct association with the maintenance and upkeep of the infrastructure. The development also ties in closely with the recent announcement of Humber Freeport Status and adds to the wider economic growth of the Humber Region. It is this growth that the NELLP is based upon and the principle of such development is therefore supported.	The Applicant appreciates the support and notes the response. **Section 23.8** of the Socio economics chapter assesses the employment opportunities available as a result of the construction and operation of the Project as well as Gross Value Added in the local economy as a result of direct and indirect employment opportunities.
	Local Residents	Supportive of the Project, but concern expressed that a hydrogen plant will reduce the value of nearby properties. How many of these jobs will be given to the local people of Immingham?	As set out within **Section 23.6**: Baseline Conditions, a number of properties located within the Site are used wholly or partly for residential purposes, which is not considered compatible with the proposed hydrogen production facility. It is intended that these will be acquired through agreement (or powers of acquisition proposed to be included in the DCO if agreement cannot be

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			reached.) As set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**, there are properties which are located on the edge of the study area, approximately 460-500m away. Due to the separation distance between these receptors and the Site, it is predicted that worst case construction noise would result in short term, temporary, very low adverse impacts. If impact avoidance measures and additional noise specific mitigation measures are implemented, residual effects at these residential NSRs during operation is assessed in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]** to be minor adverse (not significant). As also set out in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]** the Project has been designed, as far as possible, to avoid and minimise impacts and effects to landscape/seascape and visual receptors through the process of design development and by embedding mitigation measures into the design. As also explained in **Chapter 2: The Project [TR030008/APP/6.2]**, the area

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			surrounding the Port is already industrial in nature, being dominated by chemical manufacturing, oil processing and power generation facilities and beyond this, the wider area is largely agricultural. Therefore, it is not anticipated that the Project will adversely affect local house prices. It is not yet known how many employment opportunities will be taken by local residents as these have not yet been recruited for. As set out in **Section 23.8,** on average across North East Lincolnshire, 30% of those working in the area, live outside of it. Therefore, if also applied to the Project, it is assumed that 70% of employment opportunities would remain within North East Lincolnshire.
	Local Resident (living within approx. 10km of the project)	Concern that the location is not suitable for the local people of Immingham and possibility of full time employment for locals. PEI Report mentions nothing of the effects to residents	As stated within **Section 23.8**, it is proposed that a wide variety of FTE roles will be created during construction and operation of the Project. Jobcentre Plus has also offered to support with employability and skills training to maximise the local community benefits of the Project. Properties wholly or partly used for residential purposes within

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			the Site are intended to be acquired through agreement (or powers of acquisition proposed to be included in the DCO if agreement cannot be reached. As set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**, there are properties which are located on the edge of the study area, approximately 460-500m away. Due to the separation distance between these receptors and the Site, it is predicted that worst case construction noise would result in short term, temporary, very low adverse impacts. If impact avoidance measures and additional noise specific mitigation measures are implemented, residual effects at these residential NSRs during operation is assessed in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]** to be minor adverse (not significant). Other impacts to residents have been assessed separately and are reported in the following chapters: **Chapter 6: Air Quality**, **Chapter 7: Noise and Vibration**, **Chapter 11: Traffic and Transport, Chapter 13: Landscape and Visual Impact** and **Chapter 22:**

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
			Major Accidents and Disasters [TR030008/APP/6.2].
	Local Resident (living within approx. 10km of the project)	Proposed West site is partially developed with road structure and drainage? Say 200 potential jobs for the facilities – did the developer get any council or government grants/support? West Site illustration showing what appears to be a road in the foreground is misleading. Visitors questioned whether this was the A1173. Google shows it as a minor track accessing land off Queens Road. Is this information being used as part of safety review	As set out in **Section 23.8** of this assessment, it is anticipated that 134 direct FTE jobs will be created during the operation of the Project. The Site includes a temporary construction area accessed from Laporte Road. The track was previously used to access a landfill site and is now proposed to be used to access the temporary construction area. See Section 2.4 of **Chapter 2: The Project [TR030008/APP/6.2]** for further information.
	Local Resident (living within approx. 10km of the project)	Development should prioritise skills training for locals so they can get the jobs on offer.	Noted. As stated within **Section 23.8**, it is proposed that a wide variety of FTE roles will be created during both construction and operation of the Project. Jobcentre Plus has also offered to support with employability and skills training to maximise the local community benefits of the Project.
	Local Resident (living within approx. 10km of the project)	The jobcentre can help with finding customers to be able to work on the new project by helping them gain the skills and licenses required	Noted.

Reference/Date	Consultee	Summary of Response	How comments have been addressed in this chapter
	Natural England	Rights of Way, Access land, Coastal access, and National Trails Paragraphs 100 and 174 of the NPPF highlight the important of public rights of way and access. Development should consider potential impacts on access land, common land, rights of way and coastal access routes in the vicinity of the development. Consideration should also be given to the potential impacts on the any nearby National Trails. The National Trails website www.nationaltrail.co.uk provides information including contact details for the National Trail Officer. Appropriate mitigation measures should be incorporated for any adverse impacts.	PRoW have been assessed from the health perspective within **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**. The impact on users of PRoWs has also been considered within this chapter, focusing on the impact of severance of existing routes and the resulting changes in journey lengths and times, and local travel patterns. This has been assessed within **Section 23.8** and **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.
Statutory Consultation May 2023	NHS Humber and North Yorkshire	Thank you for the opportunity to consult on the proposed IGET development in Immingham and the materials you sent to that effect. This proposal has been considered by the senior management team of the ICB in North East Lincolnshire and we believe the development will make a significant contribution to the overall economic development in the Borough and aligns with our own strategic priorities for the area.	The comment from the NHS Humber and North Yorkshire is welcomed.

23.2.5 The Planning Inspectorate's Scoping Opinion (**Appendix 1.B [TR030008/APP/6.4]**) has confirmed the Applicant's view that significant effects on Tourism and PRoW links (during the operational phase) are unlikely. Accordingly, these matters are scoped out of consideration in the assessment.

23.3 Legislation, Policy and Guidance

23.3.1 **Table 23-2** presents the key legislation, policy and guidance relevant to the socio-economic assessment and details how their requirements will be met, further details are provided within **Chapter 4: Legislation and Consenting Framework [TR030008/APP/6.2]**, with the **Table 23-2** setting out relevant legislation, policy and guidance to socio-economics.

Table 23-2 Relevant legislation, policy and guidance regarding socio-economics

Legislation/Policy/Guidance	Consideration within this ES chapter
National Policy Statement for Ports (NPSfP) (Ref. 23-3)	
Paragraph 1.2.1 states that this NPS provides the framework for decisions on proposals for new port development and recognizes that ports have a vital role in the import and export of energy supplies. The NPS states that ensuring security of energy supplies through ports will be an important consideration and this infrastructure will need to be responsive both to changes in the types of energy supplies needed and changes in the geographical pattern of demand for fuel. Paragraph 3.1.7 highlights the role of ports in local, regional and national economics, through direct, indirect and induced employment opportunities. There are also associated economic benefits of 'clustering', whereby innovation is encouraged, new business opportunities created and increased productivity. Paragraph 3.3.6 states that the future development of ports support the fundamental aims of improving economic, social and environmental welfare through sustainable development and are key contributors to international and domestic trade. The benefits of port infrastructure are set out in Paragraph 4.2.3. This includes both economic, environmental and social benefits at a national level as well as locally, as a result of particular Projects. Longer benefits (such as job creation), costs of development	This NPSfP provides guidance on the relevant impacts to consider as part of the assessment. These themes have been reflected when considering the baseline analysis in **Section 23.6**, with an assessment in **Section 23.8** undertaken on the following receptors firstly during the construction phase: • Employment • Gross Value Added • Public Rights of Way • Private/public Assets: residential properties, business premises community facilities and development land • Impact of a changing influx of workers: private healthcare and accommodation As well as the following receptors during operation: • Net operational employment • Private/public Assets • Changing influx of workers: primary healthcare. This has also been taken into consideration within **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**

Legislation/Policy/Guidance	Consideration within this ES chapter
and any wider benefits to national, regional and local economies, the environment or society should be taken into consideration. Section 4.3 of the NPSfP sets out guidance for the consideration of economic impacts. This highlights the national benefits of port infrastructure associated with international trade, enhancing of gross national product, opportunities for foreign direct investment and tax revenues. This should be considered alongside the regional and local level advantages of regeneration, agglomeration benefits as well as employment and skills opportunities. The NPS sets out that these benefits may need to be quantified and demand on local public services should be considered, with sufficient weight given to positive impacts associated with economic development. Transport issues and associated mitigation are recognized as economic issues. Section 4.4 of the NPSfP sets out guidance for the consideration of commercial impacts. This sets out that Ports in England and Wales operate commercially and the impact of the development on other commercial operators will need to be considered. This should take into account proposed mitigation measures to limit increased traffic generation and objections should be considered alongside the benefits afforded to the future users of the development. Paragraph 5.14.3 states that in relation to socio-economics , it is stated that assessments should consider all relevant impacts including: • the creation of jobs and training opportunities; • the provision of additional local services and improvements to local infrastructure; • effects on tourism; • the impact of a changing influx of workers during the different construction phases, which could change the local population dynamics and alter demand for services and facilities (including community facilities and physical	

Legislation/Policy/Guidance	Consideration within this ES chapter
infrastructure such as energy, water, transport and waste). There could also be effects on social cohesion, depending on how populations and service provision change as a result of the development; and • cumulative effects arising from granted development consent from projects in the same region and built over a similar timeframe.	
Draft Overarching National Policy Statement for Energy (EN-1) (Ref. 23-27)	
This Draft National Policy Statement ("NPS") for Energy, whilst not the relevant NPS for determination of the Application pursuant to s104(2)(a) of the 2008 Act, it is potentially relevant to the consideration of the Application. Paragraph 5.13.5 states that engagement with relevant local authorities should be undertaken during early stages of project development and should describe the existing socio-economic conditions in the areas surrounding the proposed development and refer to how the development's socio-economic impacts correlate with local planning policies. Paragraph 5.13.4 states that the applicant's assessment should consider all relevant socio-economic impacts, which may include: • the creation of jobs and training opportunities, particularly the sustainability of the jobs created, including where they will help to develop the skills needed for the UK's transition to Net Zero; • the contribution to the development of low-carbon industries at the local and regional level as well as nationally; • the provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities; • any indirect beneficial impacts for the region hosting the infrastructure, in particular in relation to use of local support services and supply chains; • effects on tourism	This Draft NPS provides guidance on the relevant impacts to consider as part of an assessment of socio-economic impacts for nationally significant infrastructure projects for energy infrastructure. These themes have been reflected when considering the baseline analysis in **Section 23.6**, with an assessment in **Section 23.8** undertaken on the following receptors firstly during the construction phase: • Employment; • Gross Value Added; • Public Rights of Way; • Private/public Assets: residential properties, business premises community facilities and development land; and • Impact of a changing influx of workers: private healthcare and accommodation As well as the following receptors during operation: • Net operational employment; • Private/public Assets; and • Changing influx of workers: primary healthcare. This has also been taken into consideration within **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** and **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

Legislation/Policy/Guidance	Consideration within this ES chapter
• the impact of a changing influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure. This could change the local population dynamics and could alter the demand for services and facilities in the settlements nearest to the construction work (including community facilities and physical infrastructure such as energy, water, transport and waste). There could also be effects on social cohesion depending on how populations and service provision change as a result of the development • effects on existing and proposed land uses near the project, by replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Effects on the existing use of the proposed site should be minimised, through the application of good design principles, including the layout of the project and protection of soils during construction. • impact on Public Rights of way, National Trails, and other rights of access to land. These are important recreational facilities for example for walkers, cyclists and horse riders and applicants should take appropriate mitigation measures to address adverse effects on coastal access, National Trails, other rights of way and open access land and, where appropriate, to consider what opportunities there may be to improve or create new access. In considering revisions to an existing right of way, consideration should be given to the use, character, attractiveness, and convenience of the right of way. • impacts on accommodation supply, especially during construction and decommissioning phases.	

Legislation/Policy/Guidance	Consideration within this ES chapter
• cumulative effects - if development consent were to be granted to for a number of projects within a region and these were developed in a similar timeframe, there could be some short-term negative effects, for example a potential shortage of construction workers to meet the needs of other industries and major projects within the region.	
UK National Accounts, The Blue Book: 2022 (Ref. 23-31)	
The Blue Book presents a full set of economic national accounts for the UK. They record and describe economic activity in the UK and are used to support the formulation and monitoring of economic and social policies. Within the Blue Book, this incorporates supply and use tables (SUTs), which are used and prepared using all the available information on inputs, outputs, gross value added, income and expenditure.	The 2017 United Kingdom Input-Output Analytical Tables ("IOATs") (Ref. 23-30) are consistent with the UK Blue Book and have been used to inform the multiplier assumptions, which in turn has calculated projected indirect employment as a result of the Project. The Input-Output Tables have been used to inform the methodology in **Section 23.4**, specifically with reference to calculating indirect employment. This has then subsequently informed **Section 23.8**, particularly the calculation of construction indirect employment, which then subsequently influenced the assessment related to Gross Value Added ("GVA") during construction. The multiplier assumptions have also been applied in the calculation of indirect employment in the operational phase.
National Planning Policy Framework ("NPPF") (Ref. 23-4)	
Paragraph 8 of the NPPF maintains the presumption in favour of sustainable development, which should be delivered in accordance with three main policy objective areas: economic, social and environmental. Paragraph 152 and 158 state that local planning authorities are encouraged to support the delivery of low carbon energy and associated infrastructure to increase the use of renewable and low carbon energy and help to move towards a low carbon economy.	Encouraging sustainable economic development has been considered throughout the Socio-economic assessment in **Section 23.8,** in particular with regards to economic growth in respect of GVA created during construction (refer to **Paragraph 23.8.22** to **23.8.25**).
National Planning Practice Guidance ("NPPG") (Ref. 23-5)	
The NPPG accompanies the revised NPPF. This provides guidance on planning and the economy and considers the existing and potential future needs of the population in terms of economic development, jobs and employment opportunities. The NPPG does	Economic development, jobs and employment opportunities have been assessed in **Section 23.8.**

Legislation/Policy/Guidance	Consideration within this ES chapter
not contain specific policies for Nationally Significant Infrastructure Projects ("NSIPs"), however, it states that applications in relation to NSIPs are to be determined in accordance with the decision-making framework set out in the Planning Act 2008 and relevant NSIPs, as well as any other matters that are considered both important and relevant. The contents of this guidance are not materially relevant to the assessment of socio-economics and land use effects as the content does not influence the assessment of effects relevant to the Project.	
Homes and Communities Agency ("HCA") Additionality Guidance (Ref. 23-1)	
The guidance sets out how to assess the additional impacts or additionality of local economic growth and housing interventions and includes benchmark assumptions on the scale of additionality factors, in other words, the net changes that are brought about over and above what would take place anyway.	This has been used to inform the methodology in **Section 23.4**, specifically with reference to calculating displacement and leakage (see **Table 23-5** for more detail). This has then informed **Section 23.8**, particularly the calculation of construction and operational employment, which then subsequently influences the assessments related to GVA during construction, as well as the impact of a changing influx of workers on primary healthcare and local accommodation capacity.
East Inshore Marine Plan (Ref. 23-29)	
In 2011, the Department for Environment, Food and Rural Affairs recommended a series of marine plans for the English Inshore and Offshore marine regions to the Marine Management Organization. The East Inshore Marine Plan (Marine Management Organisation, 2014) details policies which encourage developments to increase economic productivity and provide employment benefits. The Plan highlights that it is important that economic development is delivered sustainably and provides environmental and social benefits too. In this context, socio-economic factors are also referenced. The East Inshore Marine Plan has an objective to promote sustainable development of economically productive activities. This is supported by Policy EC1 which states that "Proposals that provide economic productivity benefits which are additional to Gross Value Added currently	This has been used to inform the methodology section and the relevant impacts to consider as part of the baseline analysis and assessment of potential impacts and effects during both construction and operation.

Legislation/Policy/Guidance	Consideration within this ES chapter
generated by existing activities should be supported".	
North East Lincolnshire Local Plan (Ref. 23-6)	
The North East Lincolnshire Local Plan was adopted in 2018 and provides a planning framework to meet local development needs for the period 2013-2032, with a focus on '*creating opportunities for people'*. Policy 1 states that the intention is to create 8,800 new jobs between 2013-2032, focused around five key economic sectors, two of which are: ports and logistics, and renewable energy. Policy 7 sets out a number of employment sites of which, the Project falls within two site allocations: ELR001, a strategic proposed employment allocation site on Kings Road, which is 21.6ha in size and ELR025a, a site reserved for long term business expansion.	The Project will provide a number of construction/operational/decommissioning jobs within these relevant sectors, which has been assessed as well as the impact upon Development Land in **Section 23.8**.
North East Lincolnshire Economic Strategy (Ref. 23-7)	
Produced in 2021, this document recognised that ports and logistics as well as renewable energy are two key economic sectors in North East Lincolnshire. It recognised that the ports and logistics sector continues to be one of North East Lincolnshire's largest employers and the development of the ports has helped to underpin the growth of the local economy. The ports of Immingham and Grimsby are stated to be a critical part of the supply chain for sustainable energy generation and other energy production. As well as this, renewable energy is another key economic sector in the region. It states that North East Lincolnshire forms part of the 'Energy Estuary' and investment in the renewables sector has attracted a range of inward investors and significant future development is planned. It also states that in 2020, the Humber submitted a joint bid for Freeport status, covering a 45km area, including Grimsby and Immingham (which was subsequently granted in March 2023). The key objectives of a Freeport are to attract investment, create high value jobs, promote research and development, innovation and clean technology and	The Project will create a number of employment opportunities within these key economic sectors, which is assessed in **Section 23.8**.

Legislation/Policy/Guidance	Consideration within this ES chapter
practices, which is key for the future of the local economy.	
North East Lincolnshire Economic Recovery Plan (Ref. 23-8)	
The Economic Recovery Plan outlines the short and long term plan to support local businesses, create employment opportunities and reshape our future economy, especially since the COVID-19 pandemic and the changes brought about by Brexit. Three roadmaps have been developed (Restore, Reshape and Replenish). One of the key aims of the strategy is to *'ensure low carbon and green energy is our focus, grasping the opportunity to be nationally recognised as the place for leading edge of Offshore Wind Operations and Maintenance, Renewable Power Generation, Carbon Capture, Hydrogen and Biofuel production'.*	The Project will provide new port infrastructure which will foster the local authority's aspiration to develop its energy sector locally. As part of this, the Project will facilitate growth of the local energy sector by creating a number of local employment opportunities and contributing gross value added (GVA[2]), which is assessed in **Section 23.8**.
Greater Lincolnshire Local Enterprise Partnership ("LEP") Strategic Economic Plan (Ref. 23-9)	
The Strategic Economic Plan was produced in 2016 by Greater Lincolnshire LEP, consisting of the Unitary Authorities of North and North East Lincolnshire, the County of Lincolnshire and seven districts. One of the key priorities is listed as seeking to drive growth of the area's defining and strongest sectors, one of which is the low carbon economy, with a particular focus on renewable energy, and, to grow specific opportunities identified as future defining features of the area, one of which is ports and logistics.	The Project will seek to develop the local energy, ports and logistics sectors, which is assessed in **Section 23.8**.

[2] Gross Value Added (GVA) is the measure of the value of goods and services produced in an area, industry or sector of an economy.

23.4 Assessment Method

Methodology

23.4.1 There is currently no industry-recognised guidance on methodology for undertaking assessments of socio-economic effects. The assessment follows best practice methodology from other assessments undertaken on comparable port infrastructure schemes.

23.4.2 The Project has the potential to result in a wide range of socio-economic effects from the construction stage, through operation and decommissioning, which differ in permanence. For the purposes of this assessment, due consideration is given to the Project in terms of effects on or arising from the following:

a. Socio-economics (employment and GVA);

b. Recreational routes and ProW (for construction and decommissioning only);

c. Private/public assets (including residential properties, business premises, agricultural land and community facilities);

d. Development land; and

e. Influx of workers.

23.4.3 In the assessment of development land, planning applications are included if: they are within the relevant study area (500m from the Site) as described in **Table 23-11**; are either consented or pending approval; and are of relevance to the receptors in this socio-economic assessment.

23.4.4 Further details on the methodology for the socio-economics assessment of the Project are detailed below:

a. An assessment of the likely scale, permanence and significance of effects associated with socio-economics, recreation, and private/public assets receptors; and

b. An assessment of the potential cumulative impacts with other schemes within the surrounding area. This has also been taken into consideration within **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

23.4.5 The assessment of potential socio-economic impacts uses, where relevant, policy thresholds or standards and professional judgment to assess the scale and nature of the impacts of the Project against baseline conditions. For socio-economics, there is no generally accepted definition of what constitutes a significant (or not significant) socio-economic effect. Effects are generally categorised based upon the relationship between the scale (or magnitude) of impact and the sensitivity (or value) of the affected resource or receptor.

23.4.6 Duration of impact is also considered, with more weight given to reversible long-term or permanent changes than to temporary ones. Temporary impacts are considered to be those associated with the construction works. Long-term permanent impacts are generally those associated with the completed and operational development. For the purposes of this assessment, short term impacts are considered to be of one year or less, medium term impacts of one to four years and long-term impacts of five or more years.

23.4.7 As such, the socio-economic effects have been assessed on the basis of:

a. Consideration of sensitivity to impact: specific values in terms of sensitivity are not attributed to socio-economic resources/receptors due to their diverse nature and scale; however, the assessment takes account of the qualitative (rather than quantitative) 'sensitivity' of each receptor and, in particular, their ability to respond to change based on recent rates of change and turnover (if appropriate).

b. Scale of impact: this entails consideration of the size of the impact on people or business in the context of the area in which effects will be experienced.

c. Scope for adjustment or mitigation: the socio-economic study is concerned in part with economies. These adjust themselves continually to changes in supply and demand, and the scope for the changes brought about by the Project to be accommodated by market adjustment therefore requires consideration.

23.4.8 The assessment aims to be objective and quantifies effects as far as possible. However, some effects can only be evaluated on a qualitative basis. Effects are defined as follows:

a. Beneficial classifications of effect: indicate an advantageous or beneficial effect on an area.

b. Negligible classifications of effect: indicate imperceptible effects on an area.

c. Adverse classifications of effect: indicate a disadvantageous or adverse effect on an area.

d. No effect classifications: indicate that there are no effects on an area.

23.4.9 Based on consideration of the above, where an effect is assessed as being beneficial or adverse, the scale of the effect has been assigned using the below criteria:

a. Minor: a small number of receptors are beneficially or adversely affected. The effect will make a small measurable positive or negative difference on receptors at the relevant area(s) of effect.

b. Moderate: a noticeable number of receptors are beneficially or adversely affected. The effect will make a measurable positive or negative difference on receptors at the relevant area(s) of effect.

c. Major: all or a large number of receptors are beneficially or adversely affected. The effect will make a measurable positive or negative difference on receptors at the relevant area(s) of effect.

23.4.10 Those effects which are found to be moderate or major are considered to be 'significant' and those which are minor or negligible are 'not significant'.

Economic Impact

23.4.11 The following criteria have been used to assess the effects on receptors in relation to employment and GVA which have been grouped together as economic impacts. **Table 23-3** Table 23-3 identifies the sensitivity criteria that have been used to inform the assessment of socio-economic receptors relating to employment and GVA in conjunction with the magnitude criteria set out in **Table 23-4** to establish the significance of identified effects.

Table 23-3 Economic Sensitivity Criteria

Sensitivity	Description
High	Businesses, workers or residents who have little or no capacity to experience impacts without incurring an economic loss or have capacity to experience an economic gain.
Medium	Businesses, workers or residents that have a moderate or average capacity to experience impacts without incurring a change in their economic well-being.
Low	Businesses, workers or residents that generally have adequate capacity to experience impacts without incurring a change in their economic well-being.
Negligible	Businesses, workers or residents that are unlikely to have their economic well-being affected.

23.4.12 **Table 23-4** identifies the magnitude of impact criteria which have been used to assess the socio-economic receptors relating to employment and GVA.

Table 23-4 Economic Impact Magnitude Criteria

Sensitivity	Description
High	An impact that is expected to have considerable adverse or beneficial socio-economics effects. Such impacts will typically affect large numbers of businesses, workers or residents.
Medium	An impact that will typically have a noticeable effect on a moderate number of businesses, workers or residents, and will lead to a small change to the study area's baseline socio-economic conditions.
Low	An impact that is expected to affect a small number of businesses, workers or residents; or an impact that may affect a larger number of receptors but does not materially alter the study area's baseline socio-economic conditions.
Negligible	An impact which has very little change from baseline conditions where the change is barely distinguishable, approximating to a 'no change' situation.

23.4.13 The economic impact of the Project is considered relative to the North East Lincolnshire Local Authority area, as shown in **Figure 23-5 [TR030008/APP/6.3]**. This is considered a reasonable area in light of the likely time which workers will spend commuting to the Project and therefore represents the principal labour market catchment area. **Table 23-5** provides details on the definitions of study areas such as this which apply in this chapter.

23.4.14 Additionality[3] has been calculated by considering the overall impact of job gains to the area, the level of leakage and the number of displaced jobs. These assumptions have been informed by the Homes and Communities Agency ("HCA") Additionality Guidance (Ref. 23-1) and Origin and Destination Census data (Ref. 23-27). Indirect employment has been calculated utilising the ONS Sectoral Job Type I Multipliers (Ref. 23-30), such as supply chains and worker spending related jobs.

23.4.15 **Table 23-5** below outlines the values that have been applied to the construction, operation, and decommissioning phases in the additionality formula, enabling the tailored calculation of the net additional employment and economic impacts. Justifications for the values are summarised in the right-hand column of the table.

Table 23-5 Calculation of employment generation assumptions

Additionality Factor	Value	Justification
Leakage (% of jobs that benefit those residents outside the Project's study area)	30% (Ref. 23-27)	Relating to employment from outside the study area – this is the proportion of jobs taken by people who live outside of the study area of North East Lincolnshire Local Authority Area, as described in Paragraph **23.8.10 to 23.8.11** .
Displacement (% of jobs that account for a reduction in related jobs in the Project's study area)	25% (Ref. 23-1)	For the purpose of this assessment, a low level of displacement (25%) has been assumed, in line with the HCA Additionality Guidance (Ref. 23-1).
Multiplier (further economic activity associated with the additional local income, supplier purchase and longer-term development effects)	Various: see **Table 23-17** and **Paragraph 23.8.7**	The multiplier is a composite figure which is applied to direct job estimates to estimate indirect jobs demand. The sector categorisations covered include construction (generic), manufacture of industrial gases, and transport (by land and by water).

[3] Additionality is defined as "the extent to which activity takes place on all, on a larger scale, earlier or within a specific designated area or target group as a result of the intervention" (Ref. 23-1).

Public Rights of Way ("PRoW") Impact

23.4.16 The following criteria have been used to assess the effects on users of PRoW focussing on the impact of severance of existing routes and the resulting changes in journey lengths and times, and local travel patterns.

23.4.17 **Table 23-6** identifies the sensitivity criteria that have been used to inform the assessment of PRoW, in conjunction with the magnitude criteria set out in **Table 23-7** below, to establish the significance of the identified effects.

Table 23-6 PRoW Sensitivity Criteria

Sensitivity	Description
High	PRoW is of high importance with limited potential to substitute other route options for access to the wider network or community infrastructure.
Medium	PRoW is of medium importance with moderate potential to substitute other route options for access to the wider network or community infrastructure; or PRoW is of high importance with alternative routes available.
Low	PRoW is of low importance with alternative routes available; or PRoW is of very low importance with moderate potential to substitute other route options for access to the wider network or community infrastructure.
Negligible	PRoW is of very low importance with alternative routes available.

23.4.18 **Table 23-7** identifies the magnitude of impact criteria which have been used to assess the impacts on PRoW.

Table 23-7 PRoW Magnitude Criteria

Magnitude	Description
High	Substantial increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Medium	Noticeable increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Low	Slight increase/decrease in journey length and/or travel patterns and increased/decreased opportunities for users to access the wider network and/or community infrastructure.
Negligible	No increase or decrease in journey length and/or travel patterns and no increase or decrease in opportunities for users to access the wider network and/or community infrastructure.

Private/public Assets (residential properties, business premises, community facilities) Development Land, and Changing Influx of Workers Impacts

23.4.19 The following criteria have been used to assess the effects on private/public assets comprising residential properties, business premises, agricultural land, community facilities, development land, and effects on resources from the influx of workers i.e. access to housing/accommodation and primary healthcare.

23.4.20 **Table 23-8** identifies the sensitivity criteria that have been used to inform the assessment of effects relating to these, which in conjunction with the magnitude criteria set out below, establish the significance of the identified effects.

Table 23-8 Private/public Assets, Development Land and Changing Influx of Workers Sensitivity Criteria

Sensitivity	Description
High	Private/public asset, development land or resource is of high importance and rarity with limited potential for substitution or access to alternatives
Medium	Private/public asset, development land or resource is of medium importance and rarity with moderate potential for substitution or access to alternatives.
Low	Private/public asset, development land or resource is of low importance and rarity with alternatives available.
Negligible	Private/public asset, development land or resource is of very low importance and rarity with alternatives available.

23.4.21 The magnitude of change to private/public assets and development land is assessed by appraising the level of impact on the receptor and the permanence of change arising from the Project.

23.4.22 **Table** 23-9 identifies the magnitude of impact criteria which have been used to assess the impacts on private/public assets and development land.

Table 23-9 Private/public Assets,Development Land and Changing Influx of Workers Impact Magnitude Criteria

Magnitude	Description
High	An impact that permanently affects the integrity and value of a private/public asset or development land or a resource or an impact that considerably enhances the value and quality of an amenity or land use.
Medium	An impact that negatively affects the value of a private/public asset or development land or a resource, but a recovery is possible with no permanent impacts; or an impact that improves key characteristics and features of the amenity or land use.
Low	An impact that negatively affects the value of a private/public asset or development land or a resource, but a recovery is expected in the short-term with no change to its integrity; or an impact that has some beneficial impact on the attributes of the asset or development land.
Negligible	An impact which is a very minor loss or benefit from baseline conditions where the change is barely distinguishable, approximating to a 'no change' situation.

Significance Criteria

23.4.23 Socio-economic effects are a reflection of the relationship between the sensitivity of the affected receptor and the magnitude of the impact. The determination of significance is given in **Table 23-10**. Those effects which are found to be moderate or major are considered to be 'significant' (highlighted), and those which are minor or negligible are 'not significant'.

Table 23-10 Impact Assessment and Significance

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Limitations and Assumptions

23.4.24 The information presented in this assessment reflects that obtained and evaluated at the time of reporting and assessed within the context of the relevant study areas, as set out in **Table 23-11**.

23.4.25 The assessment of the significance of effects has been undertaken using a benchmark of current socio-economic baseline conditions prevailing at the Site and surrounding area, as far as is possible within the limitations of such a dataset.

23.4.26 Baseline data is subject to a time lag between collection and publication. As with any dataset, these conditions may be subject to change over time which may influence the findings of the assessment.

23.4.27 Baseline conditions reported in **Section 23.6** regarding population and labour force and the local economy are based on latest data available at the time of writing. The assessment of effects reported in **Section 23.8** is based on latest available data. Where conditions are likely to have been influenced by the effects of Covid-19 or other wider trends, explanatory commentary is provided.

23.4.28 Construction and operational employment figures have been based upon professional judgement through experience of assessments undertaken on schemes which are similar in scale, sector and location to the Project. As set out in **Table 23-15,** it is assumed that an average of 351 direct workers would be required across the construction period. This has been presented as an average over the 11 year construction period. The first of these phases is projected to last for 36 months (three years), with phases 2-6 projected to last for 24 months (two years). Phase 1 will have the highest employment numbers associated with it, as this is the only phase when the marine workforce will be required and will also be the peak of the landside employment workforce. Phases 2-6 will be landside only and is projected to require approximately half of the workforce numbers associated with Phase 1. Employment numbers have therefore been presented as an average number on Site over the course of the Project. For operational employment, it has been assumed for this ES, as indicated in **Chapter 2: The Project [TR030008/APP/6.2]**, that a base level of operation would require 120 workers on the landside. The marine terminal will operate 24 hours a day, seven days a week and 365 days a year (though with lower activity at night compared to the day). The terminal will have capacity to accommodate up to 292 vessel calls per year, and it is anticipated that up to 12 of these calls will be associated with the hydrogen processing facility. These vessel numbers have been assessed as a worst-case scenario, in terms of potential environmental effects, in the relevant topic chapters of this ES. Therefore, operational staff numbers for the terminal on the marine side are likely to be 14, with at least some staff working to shift systems. This therefore results in a total operational workforce of 134.

23.4.29 There is one PRoW within the Site as shown on **Figure 23-2 [TR030008/APP/6.3]**. Public Bridleway 36, which runs north from Laporte Road to the Humber, along the east edge of the Long Strip woodland will be temporarily partially closed and diverted during the first phase of the construction phase of the Project as shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**.

23.4.30 Public Footpath 32 abuts the boundary of the Site, but is assumed not to be affected by the Project as the only relevant work in this area is the underground pipeline corridor which it is assumed would be constructed using Horizontal Directional Drilling. This PRoW is also not in active use.

23.4.31 Impacts on PRoW during the operational period have not been assessed as it is assumed that Public Bridleway 36 would be reopened as referred to in **Table 23-1**.

23.4.32 Until the land use planning consultation zones are defined by the Health and Safety Executive ("HSE") through consideration of the Hazardous Substances Consent application for the Project (submitted to NELC by Air Products in April 2023), it is assumed there would be implications for land use and development in the vicinity of the hydrogen production facility in terms of major hazard planning.

23.4.33 It is assumed that the residential use of the whole or part of certain properties on Queens Road within the Site Boundary would cease permanently before the operational phase commences (i.e. during construction). The residential use of these properties (totalling ten individual residential units) on the west side of Queens Road will cease, as residential use is not compatible with the operation of the hydrogen production facility on the West Site. Negotiations are ongoing with the owners for acquisition of the whole of these properties by agreement and acquisition powers are proposed to be included within the DCO.

23.4.34 Two of the above properties are only partly in residential use. The ground floor at 7-8 Queens Road is understood to be a vacant commercial premises and the ground floor at 18 Queens Road is understood to be used as storage by the owner. As stated above, the whole of these properties are proposed to be acquired during construction, given their part residential use. Despite one of these properties being vacant and the other being utilised for storage, the potential for future employment will also be lost, which is estimated to represent approximately ten gross jobs. This is an estimate of maximum existing employment lost to reflect a worst-case scenario.

23.4.35 It is considered that other businesses adjacent to the Site Boundary and within the vicinity, are compatible with the operation of the hydrogen processing facility and, save as explained above, will be able to continue to trade during construction, operation and decommissioning. Discussions with any likely affected landowners and occupiers in terms of any implications for the safety planning of their operations have taken place and will be ongoing.

23.4.36 As set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, during construction, there would be some localised highway works to Kings Road, Queens Road and Laporte Road and any road closures would be managed and agreed with the Local Highway Authority with suitable diversion routes in place e.g. via Kiln Lane.

23.4.37 It is also assumed that while Public Bridleway 36 is temporarily diverted for construction of the Project, recreational sea anglers, including any clubs, will no longer have access along the sea front in the area shown on **Figure 23-6 [TR030008/APP/6.3]**. However once Public Bridleway 36 has re-opened on its original alignment, it is anticipated that access for the sea anglers will be possible along the sea front, up to the point where Public Bridleway 36 enters the Long Strip woodland (see **Figure 23-1 [TR030008/APP/6.3]**).Temporary closure of informal access through the southern part of the Long Strip woodland, south of Laporte Road would be required during the construction of the Project in order to limit the number of walkers crossing Laporte Road in close proximity to the

construction works in this area. In addition, the permanent removal of informal access would be required between the APT Jetty and the point at which Public Bridleway 36 meets the sea wall (see area shaded pink on **Figure 23-6 [TR030008/APP/6.3]**). This access would need to be removed permanently to enable construction and operation of the new terminal and continued informal access west of the proposed jetty would be incompatible with this. The closure of these informal accesses is shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**

23.4.38 Effects resulting from the changing influx of workers on primary healthcare facilities during the construction and operation phases have been considered within **Section 23.8** of this assessment. This ascertains whether current capacity at GP surgeries can accommodate demand arising from the workforce created as a result of the Project. It is recognised that employment numbers will peak during phase 1, both for the landside (792) and the marine side (220), totalling 1,012 workers. Peak employment numbers have been applied when assessing the impact of a changing influx of workers on local primary healthcare facilities as these are representative of the worst-case scenario.

23.4.39 Effects resulting from the changing influx of workers on local accommodation capacity have been estimated utilising two sources: the 2021 Census (Ref. 23-23) and the latest English Housing Survey (Ref. 23-24). The 2021 Census estimates the number of households within each of the local authority area, including the number of privately rented households. The English Housing Survey estimates the number of dwellings in a local authority area considered to be vacant. For North East Lincolnshire, the 2021 Census reported 22.4% of households to be privately rented and 3.9% of the total dwellings in the area to be vacant. The same tenure mix (i.e. 22.4%) has been applied the total number of vacant dwellings to estimate the supply of rented households in the study area. As set out in **paragraph 23.4.38**, during construction, this has been based on assumptions made around peak employment numbers (1,012), as a worst case scenario.

23.4.40 It is recognised that there is potential for a cumulative effect on construction labour force availability if the construction period coincides with the construction of other planning applications in the Yorkshire and Humber region, either those approved, pending determination or in preparation. A list of possible cumulative schemes is provided in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]**.

23.5 Study area

23.5.1 The impacts of the Project are considered at varying spatial levels according to the nature of the effects considered. This approach is consistent with HCA Additionality Guidance (Ref. 23-1).

23.5.2 The potential economic impacts arising from the Project have been considered relative to the North East Lincolnshire Local Authority area. The Grimsby Travel to Work Area (“TTWA”) provides an alternative study area, which was considered, but this is derived from Census 2011 data (Ref. 23-27). More recent data on employment and related indicators are available at a local authority level,

including Census 2021 (Ref. 23-23) data. As such the North East Lincolnshire local authority area was selected as the appropriate study area for this assessment.

23.5.3 The assessment of effects on PRoW considers those resources likely to be affected by closures and diversions of routes. The study area therefore includes PRoW located in or within 500m of the Site.

23.5.4 The principal impacts on private/public assets are assessed on a geographical scale. Direct impacts on these relating to land take and access are assessed based on the Site and immediate vicinity. Impacts on these as a result of community severance are also assessed. Therefore, residential and business premises within the Site or within 500m of it and community facilities within 1.5km have been identified as being within the study area. For development land, applications within the Site or those within 500m of it have also been considered on the basis that these could be directly affected by the Project by land take, or indirectly in relation to access.

23.5.5 The effects associated with the influx of new workers associated with the Project, considers receptors such as capacity at local primary healthcare facilities (GP surgeries) and accommodation facilities. Those located within 5km of the Site have been considered in the assessment.

23.5.6 **Table 23-11** presents a summary of the different components of the socio-economics assessment, the geographical scale at which each component is assessed and the rationale for the area of geographical impact chosen.

Table 23-11 Socio-economic impacts by geographical scale

Impact	Geographical Area of Impact	Rationale for Impact Area
Employment generation during the construction phase, operational phase and decommissioning phase (direct and indirect impacts)	North East Lincolnshire Local Authority Area	Range of local centres included within the area and more current data available for this geography.
GVA during the construction phase		
PRoW	The Site and the land within 500m of the Site.	Professional judgment and experience from other schemes in England, considering routes likely to be impacted by the Scheme.
Private/public assets – residential properties	Properties within the Site and those located within a 500m radius from the Site.	Professional judgement and location of sensitive receptors for impacts arising from the Project as informed by other assessments.

Impact	Geographical Area of Impact	Rationale for Impact Area
Private/public assets – business premises	Properties within the Site and those located within a 500m radius from the Site.	Professional judgement and location of sensitive receptors for impacts arising from the Project as informed by other assessments.
Private/public assets – community facilities	Community facilities within 1.5km from the Site have been assessed.	Professional judgement and location of sensitive receptors for impacts arising from the Project as informed by other assessments.
Private/public assets – Development Land	The Site and immediately adjacent land (within 500m)	Professional judgement and experience from other schemes in England.
Changing influx of workers – Primary Healthcare	A radius of 5km from the Site	Professional judgement and experience from other schemes in England.
Changing influx of workers- Accommodation	North East Lincolnshire Local Authority Area	Professional judgement and experience from other schemes in England.

23.6 Baseline Conditions

Current Baseline

23.6.1 In order to assess the potential effects of the Project, the environmental conditions, resources and sensitive receptors that currently exist in the relevant study areas have been determined. These include:

a. The existing Site and land use, including development land;
b. Population and labour force;
c. The local economy;
d. PRoW;
e. Residential properties;
f. Business premises;
g. Community facilities;
h. Primary healthcare facilities (GP surgeries); and
i. Accommodation facilities.

23.6.2 Potential effects arising from the Project are assessed relative to the baseline impact areas set out in **Table 23-11** and benchmarked against local, regional and

national standards where appropriate. Therefore, baseline conditions have been provided for these areas.

Existing Site and Land Use, including Development Land

23.6.3 As set out in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.4]**, the Project is located within an area characterised as an industrial landscape type for the areas surrounding the Port. Beyond the industrial landscape, the wider area is largely agricultural. Part of the Site lies within the operational Port and has been in active use for port purposes since 1912 and is currently used for bulk cargo, steel sections and lorry and automotive storage.

23.6.4 The Project is located nearby to Immingham town centre, which lies approximately 1km west of the Site, and Grimsby town centre is located approximately 5km to the south east. The A1173 runs along the border of the west Site, which in turn connects to the A180, a dual carriageway.

23.6.5 The border of the East Site runs alongside Queens Road and partially Kings Road. Laporte Road also crosses the Site for approximately 250m. A number of residential and part residential properties located on the western side of Queens Road are included within the Site as listed in **Chapter 2: The Project [TR030008/APP/6.2].** As noted above (**Paragraph 23.4.33**), it is anticipated that the residential use of 10 units on the west side of Queens Road will need to cease permanently as residential use is not compatible with the operation of the hydrogen production facility on the West Site. Discussions are ongoing to acquire these properties by agreement (and powers of acquisition are proposed to be included within the DCO).

23.6.6 As set out in **Paragraph 23.6.28**, two of the properties proposed to be acquired are part residential and part non-residential. The ground floor at 7-8 Queens Road is understood to be vacant and the ground floor at 18 Queens Road is understood to be used as storage by the owner. 23.6.5

23.6.7 There are also a number of other businesses located on Queens Road within the vicinity of the Site. It is considered that all of these businesses are compatible with the operation of the hydrogen production facility and will be able to continue to trade. Discussions with any likely affected landowners and occupiers in terms of any implications for the safety planning of their operations have taken place and will be ongoing.

23.6.8 There is one extant planning permission, granted for the West Site for industrial development (DM/1027/13/OUT), which has been subject to renewal applications and discharge of conditions applications (Ref. 23-9). This planning permission has been implemented by works associated with delivery of an access road, however, reserved matter approval has not been applied for in respect of the main development and subject to confirmation of the DCO, ABP do not intend to apply for such consent or build out the development which is authorised under this extant planning permission. Once the DCO is confirmed, ABP will be implementing the DCO and the hydrogen production facility will be delivered by Air Products on this land.

23.6.9 There are two employment site allocations included within the North East Lincolnshire 2018 Local Plan (Ref. 23-5) relating to land which falls within the Site. These are ELR001 (also an enterprise zone) which is located on the western side of the Site and ELR025a, located at the north of the Site. On the border of the Site is site allocation ELR027, which is also a proposed employment allocation and enterprise zone.

Population

23.6.10 Within the North East Lincolnshire area, according to the latest Census data, the population reduced from 159,616 in 2011 to 156,900 in 2021 (or by 1.7%). This is in contrast to the increase of 3.7% recorded for the Yorkshire and the Humber and the 6.3% increase recorded for England and Wales during the same time period (Ref. 23-23).

Employment

23.6.11 According to the Annual Population Survey (Ref. 23-12), the unemployment rate among working age residents in the study area in 2022 was 2.3%. This is lower than the rate recorded for Yorkshire and the Humber (3.5%) and for England (3.6%).

23.6.12 Residents of working age residing in the study area had an economic activity rate of 74.7%, which is lower than that recorded for Yorkshire and the Humber (77.3%) and for England (78.8%). This is shown in **Table 23-12**.

Table 23-12 Economic Activity and Unemployment Rates

Economic Indicator	Study area	Yorkshire and the Humber	England
Economic activity rate for residents aged 16-64	74.1%	77.3%	78.7%
Unemployment rate (for residents aged 16-64)	2.3%	2.8%	3.0%

Source: Office for National Statistics (2023), Annual Population Survey 2022 (Ref. 23-12)

Qualifications and Occupational Profile

23.6.13 The latest Census data from 2021 (Ref. 23-23) shows that 21.6% of residents aged 16 years and over in North East Lincolnshire had a degree level qualification or higher (National Vocational Qualification ("NVQ") Level 4+). This is notably lower than the rate recorded for Yorkshire and the Humber (29.5%) and for England (33.9%).

23.6.14 The proportion of residents aged 16 years and over in North East Lincolnshire with no qualifications (24.2%) is also considerably higher than recorded in Yorkshire and the Humber (20.6%) and for England and Wales (18.1%) (Ref. 23-12).

Deprivation

23.6.15 Based on the 2019 Indices of Multiple Deprivation ("IMD"), North East Lincolnshire is the 66th most deprived out of 326 local authorities nationally (1st being the most deprived and 326th being the least deprived) (Ref. 23-13).

23.6.16 In all, 32 of the LSOAs within the borough are within the top 10% most deprived LSOAs in the country.

Local Economy

23.6.17 In 2021, the workforce of North East Lincolnshire comprised of approximately 69,000 employees (Ref. 23-14). According to the most recent data on commuting patterns from the 2011 Census, a majority (70%) of the workforce in North East Lincolnshire also live in the area (Ref. 23-2).

23.6.18 **Table 23-13** presents a detailed breakdown of employment by broad industrial group in North East Lincolnshire, Yorkshire and the Humber and England and Wales. Based on the most recently available data published in the UK Business Register and Employment Survey ("BRES") for 2021 (Ref. 23-14) on employment by group, the highest levels of employment are recorded in health (18.8%), manufacturing (15.9%) and transport and storage (10.1%).

23.6.19 Specific to this assessment, the construction sector contributes 3.6% of employment within North East Lincolnshire, consisting of 2,500 employees (Ref. 23-14). This is somewhat lower than the percentage it contributes of Yorkshire and the Humber region's economy (4.8%) and England and Wales as a whole (4.6%).

23.6.20 In addition, the mining, quarrying and utilities broad industrial group (which includes employment from the generation of energy) comprises 1.0% of North Lincolnshire's employees. This is broadly in-line with the Yorkshire and the Humber region (1.2%) and England and Wales proportions (1.1%).

Table 23-13 Employee Jobs by Broad Industrial Group in 2021

Sector	North East Lincolnshire (%)	Yorkshire and the Humber (%)	England and Wales (%)
Agriculture, forestry and fishing	0.1	0.6	0.6
Mining, quarrying and utilities	1.0	1.2	1.1
Manufacturing	15.9	7.6	11.7
Construction	3.6	4.8	4.6
Motor Trades	2.4	1.7	1.8
Wholesale	2.7	3.6	3.6
Retail	9.4	9.1	8.1

Sector	North East Lincolnshire (%)	Yorkshire and the Humber (%)	England and Wales (%)
Transport and Storage (including postal)	10.1	5.1	5.6
Accommodation and food services	7.2	7.5	7.1
Information and Communication	0.8	4.6	3.1
Financial and Insurance	0.9	3.6	2.7
Property	1.2	1.8	1.5
Professional, scientific and technical	4.3	9.1	6.4
Business, admin. And support services	6.2	8.9	8.9
Public administration and defense	2.0	4.4	4.7
Education	9.4	8.7	9.7
Health	18.8	13.4	14.8
Arts, Education, Recreation & other services	3.4	4.2	4.1

Source: Office for National Statistics (2022), UK Business Register and Employment Survey (BRES) (Ref. 23-14)

23.6.21 Information on overall GVA per head is only available for both North and North East Lincolnshire combined, which, in 2023, was £26,682. This is above the Yorkshire and Humber average of £24,330, though significantly lower when compared to England as a whole, where GVA per head is £31,138 (Ref. 23-15).

23.6.22 For GVA per head in the construction industry specifically, the latest data available is from 2017 and also only available for North and North East Lincolnshire combined. At this time, the sector contributed £460 million to the local economy and consisted of 8,250 workers. The GVA per worker within the construction sector in North and North East Lincolnshire is therefore estimated to be £55,757, based on the latest available data (Ref. 23-26).

Public Rights of Way

23.6.23 The North East Lincolnshire Local Plan emphasises the importance of ensuring existing PRoW are kept open and minimal disruptions to PRoW are made during the construction process.

23.6.24 As described in the **Paragraph 23.6.3**, the Project is located within an area characterised as an industrial landscape type, but beyond this, the wider area is largely agricultural in nature.

23.6.25 There are two PRoW located within, or adjacent to, the Site Boundary. These are Public Bridleway number 36 (part of England's Coast Path, connecting Laporte Road to Grimsby) and Public Footpath number 32 (connecting Queens Road to the Redwood Industrial Park) (Ref. 23-16).

23.6.26 Public Bridleway number 36 is used predominantly for recreational purposes and forms part of a wider network of PRoW. Public Footpath 32 is not in active use and abuts the boundary of the Site.

Residential Properties

23.6.27 The study area is mostly industrial and relatively sparsely populated with residential properties. The closest residential premises to the Project are located on the west side of Queens Road within the Site. This consists of a cluster of terraced properties, flats and a detached dwelling, totalling ten residential units. A large number of residential properties are also located approximately 460m to the west of the Site on the edge of the town of Immingham.

Business Premises

23.6.28 As noted above, two properties included within the boundary of the Site on Queens Road are part residential and part commercial. The business premises include a vacant commercial unit on the ground floor of 7-8 Queens Road and the use of the ground floor of 18 Queens Road for storage. Despite one of these properties being vacant and the other being utilised for storage, the potential for future employment will be lost, and this is taken into consideration within the assessment, as shown in **Table 23-15**. It is estimated that these businesses could employ a maximum of ten members of staff.

23.6.29 There are also a number of other businesses within the vicinity, bordering the Site. A full list of these are included within **Chapter 2: The Project [TR030008/APP/6.2]**.

23.6.30 Further businesses are present surrounding Prince Edward and Prince Henry Drive, on the north-eastern side of Queens Road which includes Painting and Labour Services, Boyers Industrial Turning Services Ltd (engineers), Windsor Materials Handing (forklift truck rental business), Port Equipment Engineering Ltd (Engineers), Roxton Building Services (Builders), a laboratory, a takeaway business. These are outside of the Site.

23.6.31 To the south-east of the Site, there are industrial businesses which consist of Polynt Composites UK Ltd, a chemical plant and APT Immingham, an oil tank terminal, both on the border of the Site. PD Ports, a delivery company, is located approximately 70m away from the Site.

23.6.32 Land within the border control facility's boundary not inclusive of any buildings is partially included within the Site, in the section of the pipeline corridor. It is understood that this facility has recently been completed and may become operational in future. The border control facility will be retained during the construction and operational phase of the Project. Both Queens Road Power Station (located to the east of the West Site) and Kings Road Power Station (to the west) are situated outside the Site. Both power stations are operated by

Sembcorp. To the north-west of the Site, but outside the boundary, are several businesses located approximately 200m away, which consist of shipping businesses, trucking companies, and HGV driver training. There is also a large manufacturing business located on the border of the Site.

Agricultural Land

23.6.33 Within the Site, north of Laporte Road the main proposed temporary construction area (Work no. 9) is currently utilised for agricultural purposes. This area is approximately 3ha and represents a small portion of the overall agricultural landholding. There is an area of land in the West Site (Work no. 7) previously used for agriculture which is no longer in use. This area of land already has extant planning permission for industrial development (DM/1027/13/OUT) and has been subject to renewal applications and discharge of conditions.

Community Facilities

23.6.34 Recreational sea anglers, including groups, use an area within the Site for fishing activities as part of their wider use of Immingham Sea Wall, as shown in **Figure 23-6 [TR030008/APP/6.3]**. Currently, access to the area within the Site is via an informal access between the Associated Petroleum Terminal ("APT") Jetty and the point at which Public Bridleway 36 meets the sea wall. Use is on an infrequent basis when conditions are suitable. The access between the APT Jetty to the north west of the Site and at the point at which the bridleway meets the sea wall would need to be removed permanently to enable construction and operation of the new terminal. Informal access through the southern part of the Long Strip woodland, south of Laporte Road, would also be stopped up temporarily during construction. There are a number of other fishing bays used by recreational sea anglers along Immingham Sea Wall to the east. It is understood that the area of the sea wall within the site provides some value to anglers that is not offered from other locations along the wall, though which locations offer beneficial conditions can vary depending on tidal conditions.

23.6.35 There are a number of community facilities located within 1.5km of the Site, which includes:

a. A community recycling facility excluded from the Site but bordering the pipeline corridor;

b. Within the town of Immingham, approximately 1km to the west are a range of different facilities including a veterinary practice, several sports facilities, petrol stations, large supermarkets, a variety of shops and a range of accommodation facilities;

c. Immingham East Fire Station is located within the Kiln Lane industrial estate, approximately 1km to the south of the Site;

d. The nearest open space is Homestead Park located within Immingham town centre, approximately 1.5km from the Site; and

e. There is one education facility located 1km west of the Site. This is The Canon Peter Hall Church of England Primary School.

Primary Healthcare – GP Surgeries

23.6.36 The reporting of the baseline primary healthcare provision is made with reference to guidance from the Royal College of General Practitioners, which recommends a GP:Patient ratio of 1:1,800 (Ref. 23-17).

23.6.37 The Site is located within the National Health Service ("NHS") Humber and North Yorkshire Integrated Care Board [ICB] (which replaced Clinical Commissioning Groups in 2022). As of April 2023 this ICB had 1,790,490 registered patients (Ref. 23-18) and approximately 1,059 full time equivalent general practitioners (FTE GPs) (Ref. 23-19). This equates to an average patient list size of 1,691 per FTE GP. This average list size at the ICB is thus lower than the target list size detailed above.

23.6.38 NHS General Practice Workforce data shows that there are three GP practices within 5km of the Site comprising a total of 18.1 FTE GPs. Given the industrial nature of the site location, there are not any practices within a typical walking distance of 1km. As shown in **Table 23-14**, there are a total of 37,996 patients registered at these practices. For identified practices taken as a whole, the GP:Patient ratio is 1:2,099, which is higher (i.e. worse) than the recommended ratio of 1:1,800. This is variable however, as the Roxton Practice (located approximately 1km from the Site) and Healing Partnership (located approximately 4km from the Site), exceeds the recommended ratio by some distance. However, Killingholme Surgery (located approximately 4km from the Site) is below (i.e. better than) the recommended ratio set by the Royal College of General Practitioners (Ref. 23-19).

Table 23-14 GP Practices within 5.0km of the Site.

GP Surgery Name	Number of patients	Number of GPs (FTE)	Patients per GP (FTE)
Roxton Practice	34,065	15.9	2,142
Killingholme Surgery	1,545	1.4	1,104
Healing Partnership	2,386	0.8	2,983
Total*	37,996	18.1	2,099

Note: Figures may not sum due to rounding.

Source: NHS Digital (April 2023); General Practice Workforce (April 2023) and NHS Digital (2023); Patients Registered at a GP Practice (March 2023)

Accommodation Capacity

23.6.39 According to the 2021 Census, there are 69,826 households in North East Lincolnshire, of which, 15,644 are privately rented (accounting for 22.4% of the tenure mix). This compares to 44,584 owner occupied properties (63.9%) and 9,191 socially rented houses (3.2%) (Ref. 23-23). According to the latest UK Government data (Ref. 23-24, Ref. 23-34), in 2022, approximately 3.9% of the overall housing stock in North East Lincolnshire was vacant (2,869 dwellings).

This empty housing stock could potentially be occupied by incoming workers. If the same tenure mix were to be assumed for the vacant units (i.e. 22.4% being privately rented), approximately 642 privately rented dwellings in North East Lincolnshire are currently unoccupied.

Future Baseline

23.6.40 In the absence of the Project, the future baseline is anticipated to be largely the same as the existing baseline for socio-economics and it is assumed that the Site would continue to be characterised as an industrial landscape, partially utilised as an operational port.

23.6.41 However, according to the ONS Population Projections, the population of North East Lincolnshire is projected to decrease from 159,996 in 2020 to 158,738 in 2040 which represents a decrease of -0.8%. In Yorkshire and the Humber and England as a whole, there is expected to be increases of +5.8% and +7.9% respectively (Ref. 23-21).

23.6.42 In terms of the local economy, the proportion of the population in North East Lincolnshire which is of working age is expected to reduce (from 59.7% in 2020 to 55.4% in 2040). This is however a similar picture reflected at both the regional (Yorkshire and Humber) and national (England) scale. Business and community facilities may open and close (especially given the proximity of the Site to an existing industrial area. However, it is not expected that there would be any perceptible or material changes to the local economic baseline assessment and the Project has been assessed against current baseline conditions and policies (Ref. 23-21).

23.7 Development Design and Impact Avoidance

Embedded Mitigation Measures

23.7.1 The Project has been designed, as far as possible, to avoid and minimise environmental impacts and effects through the process of design development, and by embedding mitigation measures into the design.

23.7.2 **Figure 23-1 [TR030008/APP/6.3]** and the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]** detail the proposed temporary diversion of Public Bridleway 36 during the first phase of construction (between two and a half to three years) to enable access to be maintained. A temporary diversion route is proposed between the two points BB and BA shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**. The temporary diversion would be supported by the appropriate amount of notice and would be adequately signed during the duration of the diversion to minimise disruption to users.

23.7.3 It is anticipated that existing businesses located within the vicinity of the Site on Queens Road will be able to remain operational throughout all phases of the Project (except 7-8 and 18 Queens Road). Discussions with any likely affected landowners regarding any mitigation for implications for the safety planning of their operations have taken place and will be ongoing.

23.7.4 As noted above at **Paragraph 23.4.33**, it is anticipated that all such residential properties located on Queens Road within the Site will be acquired and residential use will have permanently ceased by the operational phase. As stated in **Paragraph 23.4.34**, properties at 7-8 and 18 Queens Road are in part residential and part commercial use and are also anticipated to be acquired through the same process associated with the DCO. As set out in the Project **Equality Impact Assessment [TR030008/APP/7.8]**, the affected residents on Queens Road are being provided with support in finding alternative accommodation, including funding of support from specialist valuers and appropriate compensation payments and relocation costs.

23.7.5 The current access to the sea wall via the Long Strip would be affected during construction of the works through the temporary closure and diversion of Public Bridleway 36. During operation, it is assumed that access will continue to be provided along the sea front, up to the point that Public Bridleway 36 enters the Long Strip woodland.

Standard Mitigation Measures

23.7.6 As referenced in the **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.5]**, during construction, residents along Kings Road will be notified via a letter drop of the timings, duration and details of any works to utilities along Kings Road.

23.8 Assessment of Likely Impacts and Effects

23.8.1 The assessment has identified that the construction, operation and decommissioning phases have the potential to result in adverse and beneficial impacts and effects on socio-economics, which may be significant.

Construction

Employment during the Construction Phase

23.8.2 The construction activities associated with the Project will generate employment, both directly and also indirectly in the supply chain. The calculation of each is set out below, to arrive at a net construction employment.

23.8.3 The construction period is set out in detail in **Chapter 2: The Project [TR030008/APP/6.2]** and will extend over approximately an 11-year period, across six phases. Therefore, employment generation during this period will be of long term duration and represent a positive economic effect for a substantial period of time, but this is still considered to be temporary. The first of these phases is projected to last between two and a half to three years and would represent the peak of construction. Construction of Phases 2-6 may take up to eight years. As Phase 1 represents the peak, there will be the highest employment numbers on site during this time, as this is the only phase when the marine workforce will be required and will also be the peak of the landside employment workforce. Phases 2-6 will be landside only and are projected to require approximately half of the workforce numbers associated with Phase 1.

Employment numbers have therefore been presented to represent the average employment on Site over the course of the Project.

23.8.4 It is however recognised that employment numbers will peak during phase 1, both for the landside (792) and the marine side (220), totalling 1,012 workers. So as to predict the 'worst case' scenario, this figure has been utilised only when assessing the impact of a changing influx of workers on local services such as primary healthcare and accommodation capacity.

Direct Construction Employment

23.8.5 Direct impacts are the jobs and GVA supported directly by the economic activities associated with the Project. Employment requirements are established based on the type and nature of construction. The construction of the Project will require on average 351 gross direct full-time equivalent ("FTE"), for both the marine and land side construction activities.

Indirect Construction Employment

23.8.6 Indirect effects refer to how the direct impacts of economic activities (i.e. the construction of the Project) propagate through the supply chains of the contractor. Indirect impacts are the GVA and jobs supported through the supply chain associated with the Project.

23.8.7 Supply chain (indirect) employment effects are estimated in this assessment by applying the ONS sectoral job type I multipliers to the direct job estimates (Ref. 23-30). During the construction phase, the generic construction multiplier (2.45) is applied to the direct employment assumptions, as detailed above in **paragraph 23.8.5**.

23.8.8 Applying these multipliers to the total gross direct employment figure of 351, results in total net indirect employment of 509 across the construction period. This together generates an average of 860 total net jobs across the construction period, both across the landside and marine side.

23.8.9 For existing employment, the wholesale and retail trade multiplier (1.4) has been applied to the estimated ten direct FTE roles associated with existing businesses at 7-8 and 18 Queens Road (as detailed in **Paragraph 23.6.28**). This is an estimate of maximum direct employment lost. Further explanation of this assessment is provided in **paragraphs 23.8.16** to **23.8.18**.

Leakage

23.8.10 Leakage effects are the benefits to those outside the economic impact study area, defined as the North East Lincolnshire Local Authority area. Analysis undertaken of the latest Census data available for this indicates that in 2011, 30% of people working in North East Lincolnshire live outside of the area (Ref. 23-27). This corresponds to approximately a medium-high leakage rate as set out by the HCA Additionality Guidance (Ref. 23-1). This rate implies that, although a reasonably high proportion of employment opportunities will be retained in the effect area, a noticeable amount of jobs will be taken up by people living outside the study area.

23.8.11 An adjustment of 30% has therefore been applied to the gross construction jobs to estimate the jobs created outside the study area. Thus, it is estimated that for the duration of the Project's construction period, an average of 246 jobs for residents within North East Lincolnshire will be created and 105 jobs for residents outside of this area (both directly and indirectly), totalling 351 jobs.

Displacement

23.8.12 Displacement measures the extent to which the benefits of a development are off-set by reductions in output or employment elsewhere. Any additional demand for labour cannot simply be treated as a net benefit since it has the potential to displace workers from other positions and the net benefit is reduced to the extent that this occurs.

23.8.13 Construction workers typically move between construction projects when delays occur or to help the workforce meet construction deadlines. Due to the flexibility of the labour market, construction labour force displacement has been assumed to be low.

23.8.14 The HCA Additionality Guide (Ref. 23-1) provides standards (or 'ready reckoners') for displacement. Within the context of a construction project in the study area, a low displacement factor for 25% is considered appropriate according to the HCA. This factor is a best practice approach which is used in the absence of specific local information.

23.8.15 Applying this level of displacement to the subtotal gross construction employment figure results in an estimated total net construction employment figure of 645 jobs during the construction period.

Existing Employment

23.8.16 The assessment of employment creation has been included to reflect the creation of employment opportunities associated with the construction phase, both direct and indirect, including consideration of any existing employment uses on-site.

23.8.17 The Site is predominantly classed as industrial. It is assumed that business premises located on Queens Road (except 7-8 and 18 Queens Road), which are within the vicinity of but outside the Site, would be able to remain operational and accessible throughout the duration of the Project's construction phase.

23.8.18 As described in **Paragraph 23.6.28,** it is estimated that currently, there are up to ten direct FTE roles associated with the existing businesses located at 7-8 and 18 Queens Road. This is an estimate of maximum employment lost, as a worst-case scenario. Indirect employment associated with these ten direct FTE roles has also been calculated through application of a Sectoral Job Type I multiplier (1.4), as set out in **Paragraph 23.8.7**. The same leakage (30%) and displacement (25%) assumptions have also been applied to the loss of existing employment, which in total, results in the loss of 18 jobs, 13 of which are anticipated to be within the North East Lincolnshire Local Authority area.

Net Construction Employment

23.8.19 **Table 23-15** presents the employment generated by the Project, accounting for leakage, displacement and multiplier effects. After taking this into account, the Project will support on average 645 net jobs. As set out in **Paragraph 23.8.18**, it is also assumed that existing employment could be lost as a result of the Project (up to 10 direct FTE jobs as a worst case scenario). The same displacement factor (25%), leakage assumption (30%) and a 1.4 multiplier effect has been applied to this to account for indirect existing jobs. When this is accounted for, the Project will support a total of 627 net jobs during the construction period, 438 of which are anticipated to remain within the North East Lincolnshire local authority area.

Table 23-15 Average Net Construction Employment from the Project:

	Study area (North East Lincolnshire)	Outside study area	Total
Gross Direct construction Employment	246	105	351
Gross Indirect construction Employment	356	153	509
Subtotal Gross construction Employment	602	258	860
Displacement	-151	-65	-215
Subtotal Net construction Employment	**451**	**193**	**645**
Gross Direct Existing Employment	7	3	10
Existing Gross Indirect Employment	10	4	14
Total Gross Existing Employment	17	7	24
Displacement of Existing Employment	-4	-2	-6
Subtotal Net Existing Employment	-13	-5	-18

	Study area (North East Lincolnshire)	Outside study area	Total
Total Net Construction Employment	**438**	**188**	**627**

Source: AECOM Calculations, 2023.

Note: some figures may not sum due to rounding

23.8.20 The sensitivity of the receptor is considered to be medium, taking into account the size of the construction worker labour pool in North East Lincolnshire, which in 2021 consisted of 2,500 employees (3.6% of total workforce) (Ref. 23-14). Factoring this in, the magnitude of impact of the construction employment generation in the study area has been assessed as high. Therefore, the employment created by the construction phase of the Project is likely to have a **temporary major beneficial** effect on the North East Lincolnshire economy, which is considered significant**.**

23.8.21 A separate assessment of jobs that could be created by the Project, based primarily on assessment of project-value was prepared in 2021. This concluded that 650 direct FTE jobs could be created during construction with further employment generated within the supply chain, which in total, would likely exceed the total employment generated as stated in this Environmental Impact Assessment.

Gross Value Added during the construction phase

23.8.22 GVA creation includes growth added through direct and indirect employment opportunities.

23.8.23 Applying the average GVA per construction worker in the area to the total number of construction workers generated from the Project gives the total GVA arising from the construction period.

23.8.24 As described in the baseline section, GVA estimates are only available for both North and North East Lincolnshire combined. The average GVA per worker for both areas in the construction sector was £55,757 in 2017, which is the latest data available (Ref. 23-26 and Ref. 23-14). By applying this figure to the total construction workers (627) generated by the Project, it is estimated the construction phase will contribute nearly £35 million as an average to both economies, of which over £24 million is projected to remain within North East Lincolnshire, as shown in **Table 23-16**.

Table 23-16 Gross Value Added from the Project during the construction phase.

	Study area (North East Lincolnshire)	Outside study area	Total
GVA during the construction phase	£24,471,747	£10,487,891	£34,959,639

Source: AECOM Calculations, 2023.

23.8.25 As described in **paragraph 23.8.20**, the sensitivity of North East Lincolnshire's economy is considered to be medium. The magnitude of impact is also considered to be medium, as it is anticipated that this will have a noticeable effect on a moderate number of local businesses, workers and residents. Therefore, the GVA created by the construction phase of the Project will have a **temporary moderate beneficial** effect on the North East Lincolnshire economy, which is considered **significant.**

Public Rights of Way (PRoW)

23.8.26 Potential effects on PRoW includes impacts on users of footpaths, bridleways, byways and National Cycle Network ("NCN") routes from disruption to or diversion of journeys.

23.8.27 Changes to journey time, local travel patterns and certainty of routes for users would arise from the temporary closures and diversions of PRoW. Effects during construction on relevant routes are set out in the following paragraphs.

23.8.28 Public Footpath 32 is not currently in active use and abuts the edge of the Site. This PRoW would remain unaffected by the Project and would not need to be diverted. Thus, as there would be no impact on this route as a result of the Project, it is assessed that there would be **permanent no effect** on users of this PRoW.

23.8.29 Temporary disruption to users making journeys on Public Bridleway 36, which forms part of England's coast path, between Immingham and Grimsby. A temporary diversion route is proposed between the two points BB and BA shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**, with users being diverted around the eastern perimeter of the temporary construction area which would be established on the area defined for Work No. 9, to reconnect with the retained bridleway further to the east on the sea wall. Once the first phase of construction is completed, the bridleway would be re-instated on its current alignment and the temporary diversion would be closed.

23.8.30 The sensitivity of Public Bridleway 36 is considered to be medium, as even though it forms part of England's coast path, a suitable alternative route has been provided on an interim basis. The magnitude of impact is considered to be low, as a result of a small diversion on a temporary basis. Therefore, the impact on this route as a result of the Project will have a **temporary minor adverse** effect on the local PRoW network, which is considered **not significant**.

Private/public Assets

Residential Properties

23.8.31 There are 10 residential properties located within the Site, which includes the following:

a. 1 to 5 Queens Road;

b. 6 Queens Road (contains two residential units);

c. Flat above 7-8 Queens Road;

d. Flat above 18 Queens Road; and

e. 31 Queens Road.

23.8.32 These properties will be present during the construction phase of the Project and could continue to be occupied during this period. As set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** there would be some localised highway works to Kings Road, Queens Road and Laporte Road associated with culvert works, utilities connections and protective works of existing assets and the creation of site entrances. These works would be undertaken using powers included within the DCO. Any road closures would be managed and agreed with the Local Highway Authority, with suitable diversion routes being available, e.g. via Kiln Lane. No significant disruption is expected.

23.8.33 As explained in **Section 23.6**, the residential use of the ten residential units on the west side of Queens Road would need to cease as residential use is not considered to be compatible with the operation of the hydrogen project facility. These properties would remain accessible during the construction period, but some owners/occupiers may opt to move prior to operation. Discussions are ongoing with those landowners / occupiers with a view to negotiating acquisition of the properties and where it is not possible to acquire those properties through negotiation, acquisition powers for these properties are sought through the DCO.

23.8.34 Therefore, as a worst case scenario, the acquisition of the residential properties may impact the affected owners and occupiers of these assets on Queens Road permanently from construction. Given the fact that a number of residents' homes will be acquired directly as a result of the Project, sensitivity is assessed to be high, in the context of the impact upon the local community. However, given that the number of properties makes up a relatively small proportion of stock in the local authority area, the loss is considered to represent an impact of low magnitude. Therefore, the loss of these residential properties as a result of the Project is assessed to result in an overall **permanent moderate adverse** effect, which is considered **significant**.

Businesses

23.8.35 As set out in **paragraph 23.6.28,** there are two part commercial and part residential properties within the Site at Queens Road, at number 7-8 (currently vacant) and 18 Queens Road (currently utilised by the owner for storage purposes). Both of these premises are proposed to be acquired due to their use as part residential and part commercial.

23.8.36 As a worst case scenario, the acquisition of these businesses premises may impact the affected owners and occupiers of these assets on Queens Road permanently from construction. However, as these businesses are not considered to have active frontages, or be open to visiting members of the public, it is anticipated that they could be relocated to similar units within the study area. On this basis, sensitivity is assessed to be low. As set out in **Table 23-15**, the existing employment at these units (which also takes into consideration the loss of potential future employment opportunities) is estimated to be up to 10 jobs. This is an estimate of maximum existing employment lost, as a worst-case scenario and is considered to be relatively modest in the context of existing employment in the area. The loss of these premises is therefore considered to represent an impact of low magnitude. Overall, the loss of the business premises at 7-8 and 18 Queens Road as a result of the Project is therefore assessed to result in a permanent **negligible** effect, which is considered **not significant**.

23.8.37 In terms of other businesses within the vicinity, discussions with any likely affected landowners and occupiers in terms of any implications for the safety planning of their operations have taken place and will be ongoing. It is not anticipated that any other local businesses would be prevented from trading throughout the construction phase of the Project. As such there would be **no effect** on surrounding businesses arising during construction. There is a border control post/facility which is outside Site Boundary, but within close proximity. It is not currently operational, but is likely to be so in the future. The building will remain in situ during the construction, operation and decommissioning and there would be **no effect** on this facility.

23.8.38 There are two Sembcorp Power Station sites on Queens Road and Kings Road which are also located outside of the Site, but within the vicinity. Access to these would be retained during construction, operation and decommissioning and therefore there would be no effect arising from the Project on these businesses. As set out in **Paragraph 23.8.32**, there would be some localised highway works to Kings Road, Queens Road and Laporte Road. Any road closures would be managed and agreed with the Local Highway Authority, with suitable diversion routes being available, e.g. via Kiln Lane. No significant disruption is expected.

Agricultural Land

23.8.39 Construction of the Project will require approximately 3ha of temporary land take from an agricultural holding for a three year period. This represents a small portion of the overall landholding. The occupier has confirmed that no employment would be lost as a result of the temporary use of this land. The land temporarily used would be returned for use by the agricultural holding with no expected change in condition following construction. On this basis there would be **no effect** arising from the Project on the agricultural holding.

23.8.40 As set out in **Chapter 2: The Project [TR030008/APP/6.2]**, the West Site compromises of three fields previously used for agricultural purposes. This area will be used for the construction and operation of the hydrogen production facility and as a result will become permanently unavailable for other use. This area of land already has extant planning permission for industrial development (DM/1027/13/OUT) and has been subject to renewal applications and discharge

of conditions. Taking into account these considerations, it is assessed that there would be **no effect** on this area of on the basis that change of its use has already been planned for.

Community Facilities

23.8.41 During construction of the Project, informal access to an area through the southern part of the Long Strip woodland, south of Laporte Road which is used on an infrequent basis will be prevented. As set out in **Chapter 2: The Project [TRO30008/APP/6.2],** there will also be permanent removal of informal access to the sea wall between the APT Jetty and the point at which Public Bridleway 36 enters the Long Strip of woodland, to enable both construction and operation of the new terminal. This area is shown on **Figure 23-6 [TR030008/APP/6.3]**.

23.8.42 The sensitivity of this receptor is considered to be medium as whilst parts of the sea wall are understood to have features that provide specific value to sea anglers, it provides extensive opportunities for angling in this location including at some distance away from the Site. The magnitude of impact is considered to be low, on the basis that whilst anglers' access to this part of the sea wall is prevented, opportunities for angling remaining on the rest of the wall. PRoW 36 will reopen during operation, however, access to the area of sea wall between the APT Jetty and the point at which the PRoW diverts into the woodland will still be permanently removed. Therefore, the impact on sea anglers groups accessing this area of sea wall is considered to be **permanent minor adverse**, which is considered **not significant**.

23.8.43 A public recycling facility is located outside of, but borders the Site. The facility and access to it will be retained and it will be able to continue operating during construction, operation, and decommissioning. As such there would be **no effect** arising from the Project on this community facility.

Development Land

23.8.44 Part of the land within the Site is allocated within the North East Lincolnshire Local Plan for employment uses (and partially as an enterprise zone). As an employment use, the Project aligns with the allocation. The impacts arising from this on development land are assessed to be negligible on the basis that it is being used in line with expectations, and the overall effect of the Project on the allocation is assessed as **negligible**, which is **not significant**.

Impact of a Changing Influx of Workers – Primary Healthcare

23.8.45 The principal impact arising from the changing influx of workers will be on local amenities, with the potential for impacts on primary healthcare provision being the most likely based on the number of peak workers required during construction of the Project. During construction, the peak workforce on the landside is anticipated to be 792 workers and on the marine side, this is 220 workers (1,012 total).

23.8.46 As set out in **Paragraph 23.4.38**, it has been assumed that there will be a peak of 1,012 workers involved in the construction period across the land and marine side. Taking account of leakage, of these, 708 are anticipated to reside within the

North East Lincolnshire area, all of whom can be assumed to be registered at local GP practices already. Therefore, there are likely to be approximately 304 workers who are not currently registered at a local practice.

23.8.47 Taking a 'worst case scenario' approach, in which all of these construction workers register with local GP practices, this would increase the overall practice list size modestly from 2,099 patients per GP to 2,116 patients per GP, which remains above, (i.e. worse than) the recommended GP:Patient ratio of 1:1,800, but modestly higher than the current scenario.

23.8.48 The sensitivity of the receptor is considered to be high, given the fact that the recommended GP:Patient ratio is already exceeded during the baseline scenario. The impact magnitude is however considered to be negligible, as despite still exceeding the recommended ration, it is not significantly higher than the current scenario. Therefore, the influx of construction workers on primary healthcare as a result of the Project is assessed to have a **temporary minor adverse** effect, which is considered **not significant**.

Impact of a changing influx of workers - accommodation

23.8.49 As set out in **Paragraph 23.6.39**, according to the 2021 Census, approximately 22.4% of households in North East Lincolnshire are privately rented. (Ref. 23-23). This equates to 642 privately rented dwellings in North East Lincolnshire that are assumed to be currently unoccupied. As set out in **paragraph 23.8.46**, it is estimated that there would be approximately 304 direct workers involved in the construction phase who will be from outside the North East Lincolnshire area. These may require accommodation on a temporary basis (although it is acknowledged that some may not require this). It is anticipated that these workers could share accommodation on the basis of at least two workers per home, reducing the number of homes required.

23.8.50 Based on a worst case scenario whereby all 304 workers need accommodation on a two workers per rented property basis within the Local Authority area, the workers would require 152 homes whereby approximately 642 are available. Therefore, there is considered to be sufficient local supply to facilitate all construction workers being housed in accommodation.

23.8.51 The sensitivity of this receptor is considered to be low, given the available supply in the local area. The impact magnitude is considered to be negligible, as this will have a very limited impact on availability of rented properties in North East Lincolnshire. Therefore, the influx of construction workers on local accommodation availability as a result of the Project is assessed to have a **negligible** effect, which is considered **not significant**.

Operation

23.8.52 The assessment of employment creation has been included to reflect the creation of long-term employment opportunities, both direct and indirect, once the Project is operational including consideration of any existing employment uses on-site.

Employment During Operation

23.8.53 An assessment of employment creation has been included to reflect the creation of long-term employment opportunities, both direct and indirect, once the Project is operational. The activities associated with the Project will generate employment directly and also indirectly in the supply chain. The calculation of each is set out below, to arrive at net operational employment, as shown in **Table 23-18**.

Direct Operational Employment

23.8.54 It is estimated that during operation, approximately 134 direct roles will be created. The calculation of indirect employment is set out below, to arrive at net operational employment, as shown in **Table 23-18**.

Indirect Operational Employment

23.8.55 Indirect effects refer to how the direct impacts of economic activity (i.e. the operation of the Project) propagate through the supply chains of the contractor and beyond through to the broader economy. Indirect impacts are the GVA and jobs supported through the supply chain associated with the Project.

23.8.56 Indirect employment has been calculated through the application of three different multiplier assumptions as set out in **Table 23-17**. These have been applied to the projected direct operational employment for both landside and marine side employment roles. Across the landside, it is assumed that 70 employees will be involved in the operational manufacturing, therefore a multiplier of 2.46 has been applied. It has also been projected that approximately 50 employees will be involved in transport related roles (by land) and a multiplier of 1.64 has been applied. On the marine side, it is estimated that 14 employees will be involved in transport related roles and a 1.55 multiplier has also been applied to this direct employment projection.

Table 23-17 ONS Sectoral Job Type I Multipliers

Manufacture of industrial gases	Transport (by land)	Transport (by water)
2.46	1.64	1.55

Source: ONS (2017) Sectoral Job Type I multipliers (Ref. 23-30)

23.8.57 Applying this to the total net direct employment figure of 134 workers results in net indirect employment of 142 jobs per annum during the construction period, together generating 276 net jobs (both directly and indirectly), as shown in **Table 23-18**.

Leakage

23.8.58 As defined within **Paragraph 23.8.10** above, leakage effects are the benefits to those outside the economic impact study area, defined as North East Lincolnshire. An adjustment of 30% has been applied to the gross total operational jobs to estimate the jobs created outside the target area (Ref. 23-27).

Thus, it is estimated that over the course of the operational period, the Project will create 94 direct jobs for residents within North East Lincolnshire and 40 direct jobs for residents outside of this area.

Displacement

23.8.59 As defined within **Paragraph 23.8.14,** displacement measures the extent to which the benefits of a development are off-set by reductions in output or employment elsewhere, as there is the potential to displace workers from other positions elsewhere.

23.8.60 As with construction, a low displacement factor of 25% is considered appropriate for operation according to the HCA (Ref. 23-1). Applying the displacement factor of 25% to the total gross operational employment figure results in an estimated total net operational employment figure of 207 jobs per year.

Total Net Operational Employment

23.8.61 **Table 23-18** presents the permanent employment generated by the Project, accounting for leakage, displacement, multiplier effects. After taking this into account, the Project will support on average 207 net jobs during the operational phase. Of this, 145 job roles are anticipated to remain within the North East Lincolnshire Area.

Table 23-18 Net Employment of the proposed development in operation

	Study area (North East Lincolnshire)	Outside study area	Total
Gross Direct Employment	94	40	134
Gross Indirect Employment	99	43	142
Total Gross Employment	193	83	276
Displacement	-48	-21	-69
Total Net Employment	**145**	**62**	**207**

Source: AECOM Calculations, 2023. Note: some figures may not sum due to rounding.

23.8.62 The sensitivity of receptor is considered to be medium, taking into account the total workforce of 69,000 in North East Lincolnshire (Ref. 23-14). In this context and accounting for the additional net direct and indirect employment associated with the Project, the impact of the operational employment generation in the study area has been assessed to result in a medium magnitude of impact. Therefore, the employment created by the operational phase of the Project is likely to have a **permanent moderate beneficial** effect on North East Lincolnshire's economy, which is considered **significant**.

23.8.63 A separate assessment of jobs that could be created by the Project, based primarily on assessment of project value, was prepared in 2021. This concluded that 750 FTE direct jobs could be created for operation and maintenance with further employment generated within the supply chain which in total would likely exceed the total employment generated as stated in this Environmental Impact Assessment.

Private/public Assets

Residential Properties

23.8.64 There are no additional impacts on residential properties to that identified during construction.

Businesses

23.8.65 Discussions of any implications for the safety planning of businesses in the vicinity of the Project have taken place with likely affected landowners and occupiers and will be ongoing. It is not anticipated that any other businesses would be prevented from trading throughout the operational phase of the Project. As such there would be **no effect** on surrounding businesses arising during operation.

Community Facilities

23.8.66 There are no additional impacts on community facilities to that identified during construction.

Development Land

23.8.67 As referred to in **Section 23.4**, until the land use planning consultation zones are defined by the HSE through consideration of the Hazardous Substances Consent application for the Project (submitted to NELC by Air Products in March 2023), it is assumed there would be implications for land use and development in the vicinity of the hydrogen production facility in terms of major hazard planning.

23.8.68 The risks and hazards from a major hazard installation are greatest in the inner consultation zone and therefore restrictions on development are strictest within that zone. The Town and Country Planning (Development Management Procedures) (England) Order 2015 (Ref. 23-32) require a Local Planning Authority (in this instance, NELC) to consult HSE about certain proposed developments within the consultation zones – the trigger being those proposals that would result in an increase in population within any of the zones, such as residential developments, primary schools, old people's homes, and hospitals.

23.8.69 As a result, the sensitivity of development land around the Site is considered to be medium as a number of other employment allocations are located within the Local Authority area, as set out in the Local Plan (Ref. 23-6), and the Project is providing an employment land use. In terms of magnitude of impact on development land, this must be considered within the context of the existing baseline, whereby the land associated with the Project has been allocated for its intended use (employment), and all businesses in the vicinity of the Project are

able to remain operational (except 7-8 and 18 Queens Road). Despite the permanence of impact, there are also a number of other developments within the vicinity of the Project, with associated COMAH zones. After taking this into account, the magnitude of impact is considered to be low, as due to the industrial nature of the surrounding area, future residential development or development for other uses identified in **paragraph 23.8.68** above is considered unlikely. Therefore, the consequences for future development land in the vicinity of the Site as a result of the Project's operation are assessed to have a **permanent minor adverse** effect, which is considered **not significant**.

Changing Influx of Workers - Primary Healthcare

23.8.70 The principal impact arising from the changing influx of workers will be on local amenities, with the potential for impacts on primary healthcare of provision being the most likely based on the number of workers required during operation of the Project.

23.8.71 During the operational phase, there are an additional 134 workers estimated to be employed. Of these, 40 workers are expected to reside outside of the study area and so are unlikely to be registered at one of the local practices. Taking a 'worst-case scenario' approach, in which all of these workers register at local GP practices, it would increase the overall practice list size from 2,099 patients per GP to 2,101 patients per GP, which is only marginally higher (i.e. worse than) than current provision.

23.8.72 The sensitivity of the receptor is considered to be high, on the basis that the recommended GP:Patient ratio is already exceeded. The impact magnitude is however considered to be negligible, as despite still exceeding the recommended provision guideline, any changes to service provision arising would be imperceptible. Therefore, the influx of operational workers on primary healthcare as a result of the Project is assessed to have a **permanent minor adverse** effect, which is considered **not significant**.

Decommissioning

23.8.73 The impacts of the decommissioning period are predicted to be less than those experienced in the construction phase. This is because decommissioning would only involve the hydrogen production facility and not the marine facilities (these would continue to be maintained so that they can be used for port-related activities to meet long term need, although jetty topside infrastructure may need to be decommissioned alongside associated landside infrastructure) or jetty access road.

23.8.74 For the landside structures, the expected design life of the hydrogen production facility is around 25 years, although the operational life may be longer depending on commercial considerations.

23.8.75 Decommissioning of the hydrogen production facility would likely involve leaving underground pipelines in situ and making them safe. All above ground infrastructure would likely be dismantled and all material removed would be reused or recycled where possible or disposed of in accordance with relevant waste disposal regulations at the time of decommissioning and land restored to a

satisfactory state. It is estimated that the decommissioning period for the hydrogen production facility would last for approximately two years.

Net Decommissioning Employment

23.8.76 Employment creation includes the creation of temporary employment opportunities directly at work sites and indirectly in the supply chain, arising from the decommissioning period associated with the Project.

23.8.77 Employment requirements for decommissioning activities are presently unknown. Based on the assumption that the decommissioning activities will generate jobs, but will be considerably shorter in duration than construction, the impact magnitude is likely to be low. The sensitivity of the labour force is considered to be medium, resulting in a **temporary minor beneficial** effect, which would be **not significant**.

Public Rights of Way

23.8.78 Potential effects on PRoW resulting from the decommissioning of the Project include impacts on users of footpaths, bridleways, byways and National Cycle Routes from disruption to, or diversion of, journeys.

23.8.79 Changes to journey time, local travel patterns and certainty of routes for users would arise from the temporary closures and diversions of PRoW. Effects during decommissioning on relevant routes are set out in the following paragraphs.

23.8.80 It is anticipated that due to the nature of decommissioning of the hydrogen production facility only and the location of PRoWs, it would not be necessary for any PRoW to be temporarily or permanently diverted or closed.

23.8.81 It is understood that Public Bridleway 36 would be unaffected by the Project during decommissioning and would not need to be diverted during this phase. Therefore, as no impact on this route is anticipated, it is assessed that there would be **no effect** on users of Public Bridleway 36 during decommissioning.

Private/public Assets

23.8.82 It is not anticipated that the decommissioning phase of the Project will require further land from residential or private properties, businesses, community land and assets or from development land to that used in construction and operation and as such there would be **no effect** on private/public assets.

23.9 Mitigation and Enhancement Measures

23.9.1 Moderate adverse (significant) effects have been assessed in relation to the loss of residential properties on Queens Road during operation. No further significant adverse effects have been assessed for the Project during construction, operation or decommissioning of the hydrogen production facility.

23.9.2 As set out in **paragraph 23.8.33** above, ten properties, comprising ten residential units and two commercial premises on Queens Road are sought to be acquired as a result of the Project. The opportunity for mitigation for the loss of the residential properties and the consequences for development land in the vicinity of the Site is limited due to the nature of the Project, in that certain land uses (such as residential) would not be considered compatible with the proposed hydrogen production facility. However, as explained in **Paragraph 23.8.34**, this needs to be considered within the context of the existing baseline. The immediate area is industrial in nature and there are a number of other sites in the port which have associated COMAH zones. As set out in the **Equality Impact Assessment [TR030008/APP/7.8]**, the affected residents on Queens Road are being provided with support in finding alternative accommodation, including the funding of support from specialist valuers, and appropriate compensation payments and relocation costs. Consultation with the residents has been undertaken to understand any protected characteristics they have which may impact their ability to relocate, and to identify any additional support that may be required. This support will continue until appropriate alternative accommodation is identified.

23.9.3 As set out in **paragraph 23.8.36**, businesses located within 9-30 Queens Road (excluding 7-8 and 18) would be able to remain operational and accessible throughout the Project.

23.10 Residual Effects

Construction

23.10.1 Based on this assessment of socio-economic impacts, it is considered that there are likely to be residual significant effects associated with the construction period. These are construction employment generation (major beneficial),generation of gross value added (moderate beneficial) and loss of residential properties (moderate adverse).

Operation

23.10.2 It is considered that there is also a residual significant effect associated with employment generation (moderate beneficial) during operation.

Decommissioning

23.10.3 It is considered that there are no residual significant effects associated with the decommissioning period.

23.11 Summary of Assessment

23.11.1 **Table 23-19** below outlines a summary of the assessment on Socio-economics.

Table 23-19 Summary of potential impact, mitigation measures and residual effects

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual effect	Confidence
Construction Phase					
North East Lincolnshire's economy	Employment generation during the construction phase	Temporary major beneficial (significant)	None required.	Temporary major beneficial (Significant)	High
North East Lincolnshire's economy	GVA generation during the construction phase	Temporary moderate beneficial (significant)	None required.	Temporary moderate beneficial (Significant)	High
Users of PRoW	Impacts on Public Footpath 32 users during the construction phase	Permanent no effect (not significant)	N/A	No effect	High
	Impacts on Public Bridleway 36 users during the construction phase	Temporary minor adverse (not significant)	Appropriate signage and planned to minimise disruption to users.	Temporary minor adverse (Not significant)	High
Private/public Assets	Loss of residential properties on Queens Road	Permanent moderate adverse (significant)	Residential properties may be acquired through agreement or via acquisition powers in the DCO. Compensation payments and assistance with the	Permanent moderate adverse (Significant).	High

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual effect	Confidence
			relocation process provided.		
	Loss of commercial properties at 7-8 and 18 Queens Road	Negligible (not significant)	Properties likely to be acquired in association with the residential process.	Negligible (Not Significant)	High
	Disruption to other businesses on Queens Road	No effect	N/A	No effect	Medium
	Loss of 3ha of agricultural land (to be used as a temporary construction site)	No effect	N/A	No effect	High
	Loss of agricultural land associated with the West Site	No effect	N/A	No effect	High
	Reduced access to sea front	Permanent minor adverse	None proposed.	Permanent minor adverse (Not significant)	Medium

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual effect	Confidence
	Impacts on other: • residential properties. • business premises. • community facilities.	No effect	None required.	No effect	High
Development Land	Loss of the employment use allocation for development.	Negligible	None required	Negligible (Not significant)	High
Impact of a changing influx of workers	Impact on the capacity of local primary healthcare facilities.	Temporary minor adverse	None required	Temporary minor adverse (Not significant)	High
Impact of a changing influx of workers	Impact on the capacity of local accommodation facilities.	Negligible	None required	Negligible (Not significant)	High
Operational Phase					
North East Lincolnshire's economy	Employment generation during the operational phase	Permanent moderate beneficial (significant)	None proposed.	Permanent moderate beneficial (Significant)	High

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual effect	Confidence
	Disruption to other businesses on Queens Road	No effect	N/A	No effect	Medium
	Impacts on other: • residential properties. • business premises. • community facilities.	No effect	None required.	No effect	High
Development Land	Loss of the potential for future development as a result of major hazard planning	Permanent minor adverse (not significant)	N/A	Permanent minor adverse (Not Significant)	High
Impact of a changing influx of workers	Impact on the capacity of local primary healthcare facilities.	Permanent minor adverse (not significant)	None required.	Permanent minor adverse (Not significant)	High
Decommissioning Phase					
North East Lincolnshire's economy	Employment generation during the	Temporary minor beneficial (not significant)	None required.	Temporary minor beneficial (Not significant)	Medium

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual effect	Confidence
	decommissioning phase				
Users of PRoW	Impacts on Public Bridleway 36 users during the decommissioning phase	No effect (not significant).	N/A	No effect	High
Private/public Assets	Impacts on residential properties, business premises and community facilities.	No effect	None required.	No effect	High

23.12 References

Ref. 23-1 Homes and Communities Agency (HCA), (2014); Additionality Guide: A Standard Approach to Assessing the Additional Effect of Projects: 4th edition.

Ref. 23-2 Office of National Statistics (ONS); Census 2011.

Ref. 23-3 Department for Transport (2012), National Policy Statement for Port.

Ref. 23-4 Ministry of Housing, Communities and Local Government (2021), National Planning Policy Framework.

Ref. 23-5 Ministry of Housing, Communities and Local Government (2019), The National Planning Practice Guidance: Housing and Economic Needs Assessment.

Ref. 23-6 North East Lincolnshire Council (2018), North East Lincolnshire Local Plan.

Ref. 23-7 North East Lincolnshire Council (2016), North East Lincolnshire Economic Strategy.

Ref. 23-8 North East Lincolnshire Council (2021), North East Lincolnshire Economic Recovery Plan.

Ref. 23-9 Greater Lincolnshire Local Enterprise Partnership (2016), Greater Lincolnshire LEP Strategic Economic Plan 2014-2030.

Ref. 23-10 North East Lincolnshire Council (2022), Online Planning Portal.

Ref. 23-11 Office for National Statistics (2020), Population Estimates – Local Authority based by five year age band.

Ref. 23-12 Office for National Statistics (2021), Annual Population Survey.

Ref. 23-13 Office for National Statistics (2019), The English Indices of Multiple Deprivation.

Ref. 23-14 Office for National Statistics (2022), UK Business Register and Employment Survey 2021 (BRES).

Ref. 23-15 Office for National Statistics (2020), Regional gross value added (balanced) per head and income components.

Ref. 23-16 North East Lincolnshire Council, Online Mapping

Ref. 23-17 Royal College of General Practitioners (2005); Information Note 20.

Ref. 23-18 NHS Digital (April 2023); Patients Registered at a GP Practice- April 2023.

Ref. 23-19 NHS Digital (April 2023); General Practice Workforce – April 2023.

Ref. 23-20 Co-Star (2022), Online Mapping: Property data,

Ref. 23-21 Office for National Statistics (2020), Population Projections, Local Authority based by single year of age.

Ref. 23-22 Homes and Communities Agency (2015), Employment Density Guide, 3rd Edition.

Ref. 23-23 Office of National Statistics; Census 2021.

Ref. 23-24 Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2023); Table 125: dwelling stock estimates by local authority district: 2022

Ref. 23-25 HMSO (2012), National Planning Statement for Ports.

Ref. 23-26 Office for National Statistics (2017), Gross Value Added (Income Approach) by SIC07 industry at current basic prices.

Ref. 23-27 Office of National Statistics; Census 2011.

Ref. 23-28 Department for Energy Security and Net Zero (2023), Draft Overarching National Policy Statement for Energy (EN-1)

Ref. 23-29 Marine Management Organisation (MMO). (2014). East Inshore Marine Plan.

Ref. 23-30 Office for National Statistics (2017): UK input-output analytical tables: 2017

Ref. 23-31 Office for National Statistics (2021): UK National Accounts, The Blue Book:2021

Ref. 23-32 The Town and County (Development Management Procedure) (England) Order 2015

Ref. 23-33 UK Planning Act 2008

Ref. 23-34 Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2023); Table 615: vacant dwelling by local authority district: England, from 2004: 2022.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 24: Human Health and Well-being

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 24: Human Health and Well-being

Regulation Reference	APFP Regulation 5(2)(a)
Planning Inspectorate Case Reference	TR030008
Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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24 Human Health and Wellbeing

24.1 Introduction

24.1.1 This chapter presents the findings of the assessment of the likely significant effects of the Project on human health and wellbeing during the construction, operation and decommissioning phases. For more details about the Project, refer to **Chapter 2: The Project [TR030008/APP/6.2]** of this Environmental Statement ("ES").

24.1.2 The assessment draws on technical assessments presented elsewhere within the ES which are of relevance to human health and wellbeing (and its wider determinants[1]). These include:

a. **Chapter 6: Air Quality [TR030008/APP/6.2].**

b. **Chapter 7: Noise and Vibration [TR030008/APP/6.2].**

c. **Chapter 11: Traffic and Transport [TR030008/APP/6.2].**

d. **Chapter 19: Climate Change [TR030008/APP/6.2].**

e. **Chapter 23: Socio-economics [TR030008/APP/6.2].**

f. **Equalities Impact Assessment [TR030008/APP/7.6].**

24.1.3 A number of other technical assessments across this ES assess impacts of potential relevance to human health but have been scoped out of this assessment, as measures will be established to manage risk and ensure there are no significant effects on human health and wellbeing. These aspects have been monitored during the preparation of the assessment, and where potential health effects are identified, these have been considered in the human health chapter as relevant and appropriate, including:

a. **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]**.

b. **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2].**

c. **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.

24.2 Consultation and Engagement

24.2.1 A scoping exercise was undertaken in August 2022 to establish the form and nature of the human health and wellbeing assessment, and the approach and methods to be followed. The Scoping Report (**Appendix 1.A [TR030008/APP/6.4]**) records the findings of the scoping exercise and details the technical guidance, standards, best practice and criteria being applied in the assessment to identify and evaluate the likely significant effects of the Project on human health and wellbeing. A Scoping Opinion was adopted by the Secretary of State on 10 October 2022 **[TR030008/APP/6.4]**.

[1] Determinants of human health and wellbeing comprise the broad range of individual constitutional and behavioural factors, as well as broader environmental, social and economic factors.

24.2.2 Statutory Consultation took place between 9 January and 20 February 2023 in accordance with the Planning Act 2008 ("2008 Act"). The Applicant prepared a Preliminary Environmental Information Report ("PEI Report"), which was publicised at the consultation stage.

24.2.3 Through consideration of the responses to the first Statutory Consultation, the developing environmental assessments and through ongoing design-development and assessment, a series of changes within the Project were identified. A second Statutory Consultation took place between 24 May and 20 July 2023 in accordance with the 2008 Act and a PEI Report Addendum was publicised to support the consultation.

24.2.4 The consultation undertaken with statutory consultees to inform this chapter, including a summary of comments raised via the formal scoping opinion (**Appendix 1.A [TR030008/APP/6.4]**) and in response to the formal consultation and other pre-application engagement is summarised in **Table 24-1**. The full responses to consultation comments are included within the Summary of Consultation Responses document **[TR030008/APP/5.1]**.

Table 24-1: Summary of consultation undertaken to date for Human Health and Wellbeing

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
Scoping Report August 2022	Planning Inspectorate	The effect of odour during operation has not been scoped into the assessment or reasons provided why this has been scoped out. This matter should be considered as part of the assessment made for air quality effects, as well as part of the health and well-being assessment, should significant effects be likely to occur.	An assessment of human health and wellbeing impacts arising from emissions of dust, noise, vibration and odours during the construction, operation and decommissioning phases of the Project is set out in this Chapter and draws on assessments set out in **Chapter 6: Air Quality** and **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. This is presented in **Section 24.8**.
	Environment Agency	Emissions of dust, noise, vibration, and odours are only scoped in for assessment during construction and decommissioning. Odour during operation could potentially be an issue that needs to be scoped in; however, it may be appropriate to consider this under Chapter 5 Air Quality, as it does not appear to be covered elsewhere in the Report. The guidance that the Applicant will be expected to follow for environmental permitting can be accessed at Environmental permitting: H4 odour management - GOV.UK (www.gov.uk). We highlight the importance of the consideration of these issues in light of the close proximity of the residential properties mentioned under Chapter 3 above.	
	Planning Inspectorate	The Scoping Report seeks to scope out this matter [PRoW impacts during operation] on the grounds that no adverse effects are expected as no direct effects are anticipated on public rights of way (PRoW) and no open space has been identified in the vicinity of the Proposed Development. Given the user experience of the PRoW during project	Noted. The effects of any impact on human health and wellbeing arising from impacts on Public Rights of Way ("PRoW") during the construction and decommissioning phases is assessed in this chapter in **Section 24.8** and draws on the findings of

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
		operation would not be dissimilar to what it is currently, the Inspectorate agrees that this matter can be scoped out of the assessment. See also impacts to PRoW during operation in Chapter 22: Socio-economics.	**Chapter 23: Socio-Economics [TR030008/APP/6.2]**.
	Planning Inspectorate	The Scoping Report does not refer to potential local public concern through perception of risk from the transportation of hydrogen gas from the site. The Inspectorate considers that this matter should be scoped in to the assessment of human health and well-being.	An assessment of potential human health and wellbeing impacts arising from local public concern and mental health issues relating to perception of risk is presented in **Section 24.8**.
	UK Health Security Agency / Office for Health Improvement and Disparities	The scoping report does not make reference to the potential for local public concern through understanding of risk / risk perception. It should be noted that HyNet North West Hydrogen Pipeline Project has this potential impact scoped-in under 'Concern over hydrogen safety'. The effects related to people and communities in the near vicinity of the Project should be identified and addressed through targeted communications and mitigation programmes. For the wider public, general communication programmes in relation to the Project should provide a source of clear and objective information to increase knowledge and awareness. This approach has been accepted by PINS in the SoS Scoping Opinion.	
	UK Health Security Agency / Office for Health Improvement and Disparities	The ES should consider potential effects on mental health through risk perception / understanding of risk posed by the handling and processing of hazardous materials. When estimating community anxiety and stress in particular, a qualitative assessment maybe most appropriate. Robust and meaningful consultation with the local community will be an important mitigation measure, in addition to informing the assessment and subsequent mitigation measures. This may involve conducting resident	

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
		surveys but also information received through public consultations, including community engagement exercises. The Mental Well-being Impact Assessment Toolkit (MWIA) contains key principles that should be demonstrated in a project's community engagement and impact assessment. We would also encourage you to consult with the local authority's public health team who are likely to have Health Intelligence specialists who will have knowledge about the availability of local data. The Mental Well-being Impact Assessment Toolkit (MWIA), could be used as a methodology. The assessment should identify vulnerable populations and provide clear mitigation strategies that are adequately linked to any local services or assets. Baseline indicators the assessment would benefit from including social cohesion/connectedness, satisfaction with local area and quality of life indicators owing to their established links to mental health and wellbeing. In terms of sources, we would draw your attention to the following: •PHE Fingertips –Mental Health and Wellbeing JSNA-Area profiles with various indicators on common mental disorders (including anxiety) and severe mental illness which can be benchmarked with other local areas as well as regional and national data •Office for National Statistics -Wellbeing Indicators-Range of datasets related to wellbeing available including young people's wellbeing measures, personal wellbeing estimates and loneliness rates by local authority.	
	Immingham Town Council	The proximity of this hazardous site to existing premises seems too close.	An assessment of potential human health and wellbeing impacts of the Project on existing homes and business premises is assessed below, drawing

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
			on findings of **Chapter 6: Air Quality**, **Chapter 7: Noise and Vibration**, **Chapter 22: Major Accidents and Disasters** and **Chapter 23: Socio-Economics [TR030008/APP/6.2]**. This is presented in **Section 24.8**.
	UK Health Security Agency / Office for Health Improvement and Disparities	Our position is that pollutants associated with road traffic or combustion, particularly particulate matter and oxides of nitrogen are non-threshold, i.e. an exposed population is likely to be subject to potential harm at any level and that reducing public exposure to non-threshold pollutants (such as particulate matter and nitrogen dioxide) below air quality standards will have potential public health benefits. We support approaches which minimise or mitigate public exposure to non-threshold air pollutants, address inequalities (in exposure) and maximise co-benefits (such as physical exercise). We encourage their consideration during development design, environmental and health impact assessment, and development consent.	An assessment of potential human health and wellbeing impacts arising from air quality impacts during the construction, operation, and decommissioning phases of the Project is set out in **Section 24.8**, drawing on **Chapter 6: Air Quality [TR030008/APP/6.2]**.
	UK Health Security Agency / Office for Health Improvement and Disparities	It is noted that the current proposals do not appear to consider possible health impacts of Electric and Magnetic Fields (EMF). We request that the ES clarifies this and if necessary, the proposer should confirm either that the proposed development does not impact any receptors from potential sources of EMF; or ensure that an adequate assessment of the possible impacts is undertaken and included in the ES.	An assessment of the potential impacts from Electric and Magnetic Fields ("EMFs") has been provided in **Section 24.8**. No major sources of EMF are anticipated to arise from the Project. All cabling associated with the Project will be 132kV or lower voltage cables, and underground. Research published by National Grid ('*Undergrounding high voltage energy transmission lines*') highlights that burying of cables results in noticeably lower EMF than overhead lines. Further information is provided in the relevant assessment in **Section 24.8**.

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
	UK Health Security Agency / Office for Health Improvement and Disparities	The scoping report does not identify the approach to the identification of vulnerable populations. The impacts on health and wellbeing and health inequalities of the scheme may have particular effect on vulnerable or disadvantaged populations, including those that fall within the list of protected characteristics. The identification of vulnerable populations and sensitive populations should be considered. Baseline health data should be provided, which is adequate to identify any local sensitivity or specific vulnerable populations. The identification of vulnerable populations should be based on the list provided by the Welsh Health Impact Assessment Support Unit and the International Association of Impact Assessment (IAIA)	An assessment of the human health and wellbeing baseline, including analysis of health indicators among the population living locally, is set out in **Section 24.8** below. The human health and wellbeing baseline includes data on population, age, ethnicity, deprivation, health deprivation, self-assessment of health, and a number of wider health determinant indicators. These indicators align with Wales Health Impact Assessment Support Unit ("WHIASU") vulnerable populations list (age related groups, income related groups, groups who suffer discrimination or other social advantage, geographical groups). Additionally, Institute of Environmental Management and Assessment ("IEMA") guidance (Ref 24-1) on the typical sub-populations with vulnerability indicatively includes young age, older age, income or unemployment, health status, social disadvantage, and access or geographical factors has been used to inform the information presented in the baseline section. Additional socio-economic data relating to the local population is set out in **Chapter 23: Socio-Economics [TR030008/APP/6.2]**.
	UK Health Security Agency / Office for Health Improvement	It is noted that Chapter 23 is drafted with reference to the Healthy Urban Development Unit (HUDU) and the Welsh Health Impact Assessment Support Unit (WHIASU) guidance and as such no assessment of significance is provided for human health. The lack of an assessment of significance does not conform to the requirements of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (2017 Regulations) and as such an assessment of	The assessment of human health and wellbeing impacts below uses Healthy Urban Development Unit ("HUDU") guidance to carry out the assessment in terms of identifying wider determinants of health.. The assessment methodology incorporates the latest IEMA guidance in order to assign significance of effects: "Determining Significance for Human

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
	and Disparities	significance should form part of the Environmental Statement. HUDU and WHIASU are guidance to support health impact assessments and are not specifically designed to address health within an Environmental Impact Assessment (EIA). The ES must provide an assessment of significance for those health determinants scoped into the population and human health chapter. As there is currently not a defined approach to the assessment of significance for population and human health, it is strongly advised that any proposed approach is agreed with OHID/UKHSA and the local public health team. The guidance issued by the International Association of Impact Assessment (IAIA) could be used as a basis for the assessment of significance.	Health in Environmental Impact Assessment", recently published in November 2022 (Ref 24-1).
Statutory Consultation January 2022	North East Lincolnshire Council	The environmental protection team acknowledges the proposal and anticipates the submission of the relevant environmental assessments. The construction phase also needs to be considered and detailed construction management measures put in place. We do note that a Hazardous Substance Consent has been submitted to the LPA and is currently going through validation. However, the LPA have reservations over the potential impact of the development and its associated HSE Zones with particular regard to human health, residential amenity and the effect such zones may have on future development. We look forward to working with the applicant to further understand this issue and the impacts of the development.	From a human health perspective, perception of risk has been considered within the relevant paragraphs of the assessment (**Section 24.8**). The health assessment also makes reference to the findings of the socio-economics assessment (**Chapter 23: Socio-Economics [TR030008/APP/6.2]**) which considers impacts on residential receptors and development land.
	Polynt Composites	Other non-COMAH hazard risks to human health, such as worsening air quality, are also not dealt with adequately in the consultation documentation. Increased levels of harmful dioxins caused by both increased traffic (queuing traffic in particular), must be fully assessed and mitigated.	The assessment considers within **Section 24.8** impacts on air quality as regards human health, with reference to the findings of the Air Quality assessment within **Chapter 6: Air Quality [TR030008/APP/6.2]**. The impact of emissions from increased traffic movements and congestion is considered in Section

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
			6.8 of **Chapter 6: Air Quality [TR030008/APP/6.2]**, with reference to relevant guidance published by the Institute of Air Quality Management, National Highways and Defra. In line with that guidance, the assessment focuses on the primary pollutants of concern from such emissions.
	UK Health Security Agency	The health of an individual or a population is the result of a complex interaction of a wide range of different determinants of health, from an individual's genetic make-up, to lifestyles and behaviours, and the communities, local economy, built and natural environments to global ecosystem trends. All developments will have some effect on the determinants of health, which in turn will influence the health and wellbeing of the general population, vulnerable groups and individual people. Although assessing impacts on health beyond direct effects from, for example emissions to air or road traffic incidents is complex, there is a need to ensure a proportionate assessment focused on an application's significant effects.	The human health and wellbeing assessment recognises the definition of health stated here. The definition is set out in the methodology (**Section 24.4)**. The human health and wellbeing assessment incorporates best practice guidance with respect to scoping and assessment of effects as described by IEMA, which also informs the assessment of significance within the chapter.
	Local Resident (living within approx. 10km of the project)	Concerned about the danger associated with the storage and transport of hydrogen. What noise will be made which may affect life in Immingham? Concern for noise at night-time disturbing sleep. Will wind power be used for electricity? Concern for disturbance from this, if so. Concern that the environmental effects of the project will only be known when it is too late.	From a human health perspective, noise has been considered in **Section 24.8** with reference to noise assessments conducted in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. Moreover, perception of risk has been considered within **Section 24.8**. Similarly, the health assessment has considered socio-economic impacts, including on residential properties, with reference to **Chapter 23: Socio-Economics [TR030008/APP/6.2]**. An assessment to identify and describe potential, credible risk scenarios has been completed for the Project and associated risks will be managed by a comprehensive safety and environmental protection

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
			programme implemented via engineering design, operational measures and management to reduce risk to achieve a level 'As low as reasonably practicable' ("ALARP"), as required by the applicable regulations. Risk management will be part of an ongoing process throughout the lifecycle of the Project and a requirement for compliance with applicable legislation including the Control of Major Accident Hazards Regulations ("COMAH"), Environmental Permitting, Hazardous Substances and Pipeline Safety Regulations. Further explanation is given in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**. Wind turbines do not form part of the Application and will not be constructed as part of this Project. An assessment of Electric and Magnetic Fields is provided in **Section 24.8**.
	Local Resident (living within approx. 10 km of the project)	Environmental reports mention only wading birds and flight paths. I think potential for loss of life of Immingham residents due to explosion is a far higher priority.	From a human health perspective, perception of risk has been considered within **Section 24.8**. An assessment to identify potential, credible risk scenarios, including explosion or major fire, has been completed for the Project and associated risks will be managed by a comprehensive safety and environmental protection programme implemented via engineering design, operational measures and management to reduce risk to achieve a level ALARP, as required by the applicable regulations. Risk management, including risk assessment and consequence analysis, will be part of an ongoing process throughout the lifecycle of the Project and a

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
			requirement for compliance with applicable legislation including COMAH, Environmental Permitting, Hazardous Substances and Pipeline Safety Regulations. Further explanation is given in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**.
	Local Resident (living within approx. 10 km of the project)	I am concerned about the risk to the people of Immingham. Ammonia is highly toxic and the town is too close to the chemical works. Residents already undergoing legal aspects of CPO. Concerns about ammonia being dumped into the atmosphere and the sea. Concern that people will be at risk of chemical exposure. Suggested investing in Tidal power instead.	From a human health perspective, perception of risk has been considered within **Section 24.8**. The plant will be designed to comply with all applicable regulations and will require an environmental permit. The detailed design will ensure that ammonia is contained and appropriate measures will be taken to prevent emissions during maintenance and other periodic operations. A flare system will dispose of ammonia safely in the event of an emergency. Technical information about operation of the Project has been made available via the Project engagement activities to assist in developing understanding of the processes and help address concerns regarding safety. The reference to tidal power is noted. Government policy supports a range of technologies being used to achieve the transition to net zero. The Project would provide infrastructure designed to contribute towards the Government's aim of achieving 10GW of low carbon hydrogen production capacity by 2030, as defined in the British Energy Security Strategy, April 2022 (Ref 24-2).

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
	Local Resident (living within approx. 10 km of the project)	The hydrogen plant is further development of the agricultural land which has historically provided a buffer between port/industry and residential town. The proposed development, handling & storing of dangerous and toxic chemicals, is within 500 m of housing estates in Immingham. Any large scale accident has potential for a domino effect with all of the existing high risk sites in the area.	From a human health perspective, perception of risk has been considered within the relevant paragraphs of **Section 24.8**. Domino scenarios are considered in **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** and will also be considered by the Health and Safety Executive ("HSE") during the COMAH notification process.
	Natural England	Rights of Way, Access land, Coastal access, and National Trails Paragraphs 100 and 174 of the NPPF highlight the important of public rights of way and access. Development should consider potential impacts on access land, common land, rights of way and coastal access routes in the vicinity of the development. Consideration should also be given to the potential impacts on the any nearby National Trails. The National Trails website www.nationaltrail.co.uk provides information including contact details for the National Trail Officer. Appropriate mitigation measures should be incorporated for any adverse impacts.	PRoW have been assessed from the impact on health perspective within this **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**. The impact on users of PRoWs has also been considered within **Section 23.5 of Chapter 23: Socio-Economics**, focusing on the impact of severance of existing routes and the resulting changes in journey lengths and times, and local travel patterns. Appropriate mitigation measures associated with the temporary diversion of Public Bridleway 36, as set out in the **Stopping Up Plan [TR030008/APP/4.7]**, will be implemented including providing notice and installation of adequate signage as included within the **Outline Construction Environmental Management Plan** ("CEMP") **[TR030008/APP/6.5]**.

Reference / Date	Consultee	Summary of Response	How comments are addressed in the ES
Second Statutory Consultation May 2023	Polynt	We are concerned that the inclusion of the southern part of the Long Strip woodland within the DCO will exacerbate the already detrimental impact the IGET Project could have on the health and wellbeing of our employees as a result of the removal of trees in the vicinity of our site. Further, the proposed diversions to existing public rights of way and informal access points are also likely to have adverse impacts on the health and wellbeing of employees, particularly those who live locally.	An assessment of the human health impact resulting from the loss of trees within the Long Strip is provided within **Section 24.8** below. An assessment of the human health impact of the temporary diversion of Public Bridleway 36 has been conducted in the assessment of 'accessibility to open space, and active travel within **Section 24.8** below.

24.3 Legislation, Policy and Guidance

Legislation, Policy and Guidance

24.3.1 **Table 24-2**: presents the legislation, policy and guidance relevant to the human health and wellbeing assessment and details how their requirements will be met.

Table 24-2: Relevant legislation, policy and guidance regarding human health and wellbeing

Legislation/Policy/Guidance	Consideration within the ES
National Policy Statement for Ports ("NPSfP")	
The NPSfP (Ref 24-3) provides the framework for decisions on proposals for new port development. It is recognized that ports have a vital role in the import and export of energy supplies. It states that ensuring security of energy supplies through our ports will be an important consideration and that ports need to be responsible both to changes in the types of energy supplies needed and changes in the geographical pattern of demand for fuel. Within the document, it recognises that ports have the potential to affect the health, well-being and quality of life of the population through direct impacts on health and indirect impacts resulting from alterations to local populations. It highlights that these impacts can result from: • waste management, whereby *'government policy on hazardous and non-hazardous waste is intended to protect human health by producing less waste and using it as a resource wherever possible…waste management regulation ensures that waste is disposed of in a way that is least damaging to human health'* (paragraph 5.5.1); • water quality and resources, whereby there may be an '*increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health…*' (paragraph 5.6.2); • air quality and emissions, whereby the '*construction, operation and decommissioning phases…of infrastructure development…can involve emissions to air, which could lead to adverse impacts on human health'* (paragraph 5.7.2); • noise and vibration, whereby '*excessive noise can have wide-ranging impacts on*	Provides the framework for decisions on proposals for new port development and guidance on the likely impact pathways between port development and operation, and human health impacts. These align with the themes considered in the assessment of effects (**Section 24.8**) which, as set out in **Section 24.4**, considers: a. Access to healthcare services and other social infrastructure. b. Emission of dust, noise, vibration, and odours. c. Air/noise pollution linked with traffic. d. Accessibility to open space, and on active travel. e. Access to employment and training, particularly for local residents. f. Contribution to social cohesion and engagement with existing communities to encourage social interaction and support mental health, including perception of risk.

Legislation/Policy/Guidance	Consideration within the ES
quality of human life and health…owing to annoyance or sleep disturbance…' (paragraph 5.10.1); • land use, whereby it is recognized that *'open spaces…help to underpin people's quality of life and have a vital role to play in promoting healthy living'* (paragraph 5.13.2); and • economic impacts, including access to public services, whereby '*economic benefits from port developments include regeneration and employment opportunities…ports can contribute to the enhancement of people's skills…*' (paragraph 4.3.2 and 4.3.3).	
National Planning Policy Framework ("NPPF2)	
The latest BPPF (Ref 24-4) was published and adopted in July 2021. The NPPF consolidates the Government's economic, environmental and social planning policies for England into a single document and describes how it expects these to be applied. It provides overarching guidance on the Government's development aims. The NPPF places emphasis on achieving sustainable development including by supporting *"strong, vibrant and healthy communities"*. Chapter 8: 'Promoting healthy and safe communities' outlines the key role that planning policy has in ensuring the health and wellbeing of communities through considerations such as the availability of school places, public safety and security, and the promotion of social interaction and community cohesion. Within this chapter, the NPPF identifies key principles that local planning authorities should ensure they consider in order to achieve this aim, including: Paragraph 92 c) which states policies should aim to *"enable and support healthy lifestyles, especially where this would address identified local health and well-being needs – for example through the provision of safe and accessible green infrastructure, sports facilities, local shops, access to healthier food, allotments and layouts that encourage walking and cycling"*; and Paragraph 185 illustrates that planning policies must conserve and enhance the natural and local environment and therefore, planning decisions on new developments should account for noise	Provides guidance on the promotion of safe and healthy communities, which aligns with the themes considered in the assessment of effects (**Section 24.8**).

Legislation/Policy/Guidance	Consideration within the ES
pollution. In doing so, planning policies and decisions should attempt to *"mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and quality of life".*	
NHS Long Term Plan (2019)	
The NHS Long Term Plan (Ref 24-5) sets out a ten-year programme of phased improvements to the NHS. The plan outlines how the NHS will attempt to reduce health inequalities through wider preventative action in deprived areas and improvements to integrated community-based care systems. This includes funding support to programmes which help to reduce smoking, obesity and air pollution in vulnerable communities. There will also be an increased focus on digital GP consultations to provide more options and better support for patients. Increases in NHS funding and the establishment of a new NHS Assembly are planned to help achieve better care quality and outcomes as well as helping to reduce workforce pressures. The NHS Long Term Plan stresses the importance of the NHS and the built environment sector continuing to work together to improve health and wellbeing.	Provides context to the assessment of the Project's impacts on access to local healthcare facilities, as set out in **Section 24.8**.
Health and Care Act (2022)	
In April 2022, the Government passed a new Health and Care Act 2022 (Ref 24-6). The new Act proposes health reforms in England, removes existing competition rules and formalises Integrated Care Systems (ICS). It also grants the health secretary authority over the health service. The Act also aims to support the development of ICS and integration of all health bodies, by requiring them to strive towards the collective aims of: better care for all patients; better health and wellbeing for everyone; and sustainable use of NHS resources. There are 42 ICSs across England and each has been established with four strategic purposes: • Improve population health and healthcare; • Tackling unequal outcomes and access; • Enhance productivity and value for money; and	Provides context to the assessment (**Section 24.8**) of access to local healthcare facilities (see **paragraphs 24.8.6 to 24.8.11, 24.8.58 to 24.8.62 and 24.8.101 to 24.8.102**).

Legislation/Policy/Guidance	Consideration within the ES
• Helping the NHS to support broader social and economic development.	
Levelling Up the United Kingdom (February 2022) White Paper	
The Levelling Up the United Kingdom document (Ref 24-7) contains 12 specific missions which are set out as key objectives for the Government to deliver against. One of these missions includes that: *'By 2030, the gap in Healthy Life Expectancy (HLE) between local areas where it is highest and lowest will have narrowed, and by 2035 HLE will rise by five years'.* The goal is for the Government to tackle the existing disparities in health outcomes across the UK, ensuring that people have the opportunity to have long healthy lives wherever they live. It is stated that *'on average, people living in the most deprived communities in England have over 18 years less of their lives in good general health than those living in the least deprived areas'.* There also appear to be disparities in access to healthcare in the most deprived areas, with longer waiting lists in more deprived areas. The policy programme is focused around three key areas: • Improving public health; • Supporting people to change their food and diet; and • Tackling diagnostic backlogs.	Provides context to stated governmental ambitions to reduce health disparities and provides justification for highlighting vulnerable groups and existing deprivation within the baseline conditions (**Section 24.6**).
Planning Practice Guidance ("PPG") (2019)	
The national PPG (Ref 24-8) was first produced in November 2016 and most recently updated in October 2019. It provides a web-based resource in support of the NPPF and offers guidance on health and wellbeing in planning and planning obligations. It covers both: • The role of health and wellbeing in planning; and • The links between health and wellbeing and planning. The PPG suggests that local authority planners should consult with the Director of Public Health on mitigation measures for any planning applications that are likely to have a significant impact on the health and wellbeing of the local population or	Health and wellbeing impacts have been assessed in **Section 24.8**.

Legislation/Policy/Guidance	Consideration within the ES
particular groups. A health impact assessment is a useful tool to use when assessing expected significant impacts. The guidance states that: *"plan-making authorities may work with public health leads and health organisations to understand and take account of the health status and needs of the local population, including the quality, quantity of and accessibility to healthcare and the effect any planned growth may have on this. Authorities should also assess quality, quantity of and accessibility to green infrastructure, sports, recreation and places of worship including expected future changes, and any information about relevant barriers to improving health and well-being".* The PPG for health and safe communities covers the role of positive planning on healthier communities and how the design and use of the built and natural environments, including green infrastructure, are major determinants of health and wellbeing. The guidance states that *"planning and health need to be considered together in two ways: in terms of creating environments that support and encourage healthy lifestyles, and in terms of identifying and securing the facilities needed for primary, secondary and tertiary care, and the wider health and care system".* The PPG for open space, sports and recreation facilities, PRoW (Public Rights of Way) and local green space provides additional guidance on those designation and how they should be taken into consideration in planning. The guidance mentions that planning should consider proposals that may affect existing open space as they provide health and recreational benefits to people living and working nearby. It is for local planning authorities to assess the need for open space and, when doing so, should have regard to the duty to cooperate where open space serves a wider area.	
Public Health England Strategy 2020 to 2025	
The Public Health England Strategy 2020 to 2025 (Ref 24-9) sets out how the organisation will work to improve public health and reduce health inequalities. The most relevant of the ten priorities for focus of PHE over the next five years are set out below: '1) Smoke free society: take steps towards a smoke-free society by 2030;	Provides guidance on the relationship between the development of the built environment and health improvement priorities. The impact of the Project on health and wellbeing is assessed in **Section 24.8**.

Legislation/Policy/Guidance	Consideration within the ES
2) Healthier diets, healthier weights: help make the healthy choice the easy choice to improve diets and rates of childhood obesity; 3) Cleaner air: Develop and share advice on how best to reduce air pollution levels and people's exposure to polluted air; 4) Better mental health: Promote good mental health and contribute to the prevention of mental illness; 5) Best start in life: work to improve the health of babies, children and their families to enable a happy, healthy childhood and provide the foundations of good health into adult life; 6) Effective responses to major incidents: Enhance the ability to respond to major incidents (including pandemic influenza), by strengthening our health protection system; 7) Reduced risk from antimicrobial resistance: work to help contain, control and mitigate the risk of antimicrobial resistance; 8) Predictive prevention: utilise technology to develop targeted advice and interventions and support personalised public health and care at scale; and 9) Enhanced data and surveillance capabilities: improve the data capability and strengthen the approach to disease surveillance using new tools and techniques. In 2020, Public Health England published 'Using the planning system to promote healthy weight environments'. This document provides strategic information on the use of the planning system to promote local healthy weight environments, supporting local businesses and workplaces to provide healthier food and drink to help enable people access to healthier food and active environments. Supporting healthy diets and a healthier weight is a priority in the PHE Strategic Plan 2020-2025.	
A Green Future: 25 Year Plan to Improve Our Environment (2018)	
The Government's 25-year Plan to Improve the Environment (Ref 24-10) outlines proposed action to protect the environment and economy simultaneously. Chapter 3 which focuses on government plans to improve the connection	Provides guidance on the relationship between the development of the built environment and health improvement priorities. The impact of the Project on health and wellbeing is assessed in **Section 24.8**.

Legislation/Policy/Guidance	Consideration within the ES
between people and the environment in order to promote health and wellbeing. This includes the following objectives: "*Helping people to improve their health and wellbeing by using green spaces"* – there will be a renewed reliance on green spaces to help address issues such as isolationism and loneliness, something which is becoming increasingly prevalent with an ageing population and increased reliance on technology. It will also help to tackle obesity and act as a preventative and therapeutic approach to mental health. Encouraging children to be close to nature, in and out of school, with a focus on disadvantaged areas. The government will launch 'Nature Friendly Schools Programmes' to help communities create *"the kind of school grounds that will support learning about the natural worlds and keep children happy and healthy".* There will also be greater support for pupil contact with local natural spaces by making it easier for schools to take pupils on regular trips.	
Health Equity in England: The Marmot Review 10 Years On (2020)	
A follow up Marmot Review, Health Equity in England 10 Years On (Ref 24-11), was published in February 2020. The report highlighted the growth in health inequality over the preceding 10 years, especially for people living in more deprived districts and regions, and that for the population as a whole, health is declining. The report argues that greater levels of government intervention are required and that those areas who are most deprived should receive investment first and at higher levels. As well as this, it calls upon the Government to create a health inequalities strategy with clear targets and to create a Cabinet-level cross-departmental committee. It calls upon the government to re-order national priorities and to make wellbeing a central goal of policy, which will in turn create a better society, with better health and health equity.	Provides context to stated governmental ambitions to reduce health disparities and provides justification for highlighting vulnerable groups and existing deprivation within the baseline conditions (**Section 24.6**).
Build Back Fairer: The COVID-19 Marmot Review (2020)	
An update to the Marmot Review 10 Years On report, Build Back Fairer: The COVID-19 Marmot Review (Ref 24-12) was published in December 2020 to investigate how the pandemic has affected health inequalities in England. The COVID-19	Provides context to stated governmental ambitions to reduce health disparities in the context of the COVID-19 pandemic, and provides justification for highlighting vulnerable groups and

Legislation/Policy/Guidance	Consideration within the ES
pandemic has exposed and amplified the inequalities highlighted in the Marmot Review 10 Years On report. The report proposes that commitment to social justice and equity of health and wellbeing is at the heart of all policy-making, nationally, regionally and locally and that the economic harm caused by measures to control the virus may cause further damage to health and widening of health inequalities.	existing deprivation within the baseline conditions (**Section 24.6**).
The Marmot Review (2010)	
The Marmot Review (2010) (Ref 24-13) argues that serious avoidable health inequalities exist across England and shows these inequalities to be determined by a wide range of socio-economic factors. Health is linked to both individuals and communities. The following policy objectives are identified: • "*Give every child the best start in life;* • *Enable all children, young people and adults to maximise their capabilities and have control over their lives;* • *Create fair employment and good work for all;* • *Ensure a healthy standard of living for all;* • *Create and develop healthy and sustainable places and communities; and* • *Strengthen the role and impact of ill health prevention".*	Provides context to stated governmental ambitions to reduce health disparities and provides justification for highlighting vulnerable groups and existing deprivation within the baseline conditions (**Section 24.6**).
Institute of Environmental Management and Assessment ("IEMA") Determining Significance for Human Health in Environmental Impact Assessment	
IEMA published guidance (Ref 24-1) on the process and methodology for assessing significance of human health effects as part of Environmental Impact Assessments in 2022.	This guidance has formed the basis of the methodology used to conduct the human health and wellbeing assessment.
Institute of Environmental Management and Assessment (IEMA) Effective Scoping of Human Health in Environmental Impact Assessment	
IEMA published additional guidance (Ref 24-14) in 2022 pertaining to the scoping of human health effects. It suggests a range of health determinants to be considered as part of the scoping of human health impacts.	This guidance has been considered with respect to reviewing the scoped in health determinants during the preparation of the ES.

Legislation/Policy/Guidance	Consideration within the ES
NHS England's Healthy Urban Development Unit ("HUDU") Rapid Health Impact Assessment ("HIA") Tool	
NHS England's HUDU HIA Tool (Ref 24-15) identifies eleven broad determinants of health that are likely to be influenced by specific development proposals and can be influenced through design and management measures. It provides an assessment checklist against which the likely impacts of new developments can be assessed.	The assessment of health and wellbeing has been conducted in line with this guidance.
Wales Health Impact Assessment Support Unit ("WHIASU") Health Impact Assessment (HIA): A practical guide	
WHIASU's guidance on HIA, including HIA: A practical guide (Ref 24-16), provides guidance on best practice approach to carrying out health impact assessment.	The assessment of health and wellbeing has been conducted with regard to this guidance.
Joint Health and Wellbeing Strategy for Lincolnshire	
The role of the Lincolnshire's Health and Wellbeing Board is to bring together key people from the health and care system to work together to reduce inequalities and improve the health and wellbeing of the people of Lincolnshire. The Health and Wellbeing Board has identified a number of common aims which emerged during the engagement process which form the basis of the overarching aspirations and aims for the Joint Health and Wellbeing Strategy for Lincolnshire (Ref 24-17). These include the need for the Joint Health and Wellbeing Strategy to: • have a strong focus on prevention and early intervention; • ensure a focus on issues and needs which will require partnership and collective action across a range of organisation to deliver; • deliver transformational change through shifting the health and care system towards preventing rather than treating ill health and disability; and • focus on tackling inequalities and equitable provision of services that support and promote health and wellbeing.	Provides local policy context for the consideration of health and wellbeing in the population likely to be affected by the Project. An assessment of the health and wellbeing impacts arising from the Project on local populations is shown in **Section 24.8**.

Legislation/Policy/Guidance	Consideration within the ES
North East Lincolnshire Local Plan 2013 to 2032	
The North East Lincolnshire Local Plan (Ref 24-18) sets out aspirations to address social inequality which may be caused by health disparities. The Plan makes reference to the development of the local authority area and how this is likely to, or is able to, positively influence health outcomes. 'Policy SO5: Social and health inequality' addresses promoting healthier lifestyles and providing access to healthcare and community facilities.	Provides local policy context for the consideration of health and wellbeing in the population likely to be affected by the Project. An assessment of the health and wellbeing impacts arising from the Project on local populations is shown in **Section 24.8**.
North Lincolnshire Local Development Framework	
The North Lincolnshire Local Development Framework (Ref 24-19) sets out aspirations to promote community health and wellbeing in the local authority area. Objective 8: Promoting Community Health and Wellbeing aspires to 'promote an improvement in health and wellbeing of North Lincolnshire's people by maintaining and providing quality open spaces, play and sports facilities, better access to the countryside and improved health facilities.	Provides local policy context for the consideration of health and wellbeing in the population likely to be affected by the Project. An assessment of the health and wellbeing impacts arising from the Project on local populations, including neighbourhood amenity and access to local facilities, is shown in **Section 24.8**.
Central Lincolnshire Local Plan	
The Central Lincolnshire Local Plan (Ref 24-20) adopted in April 2017 makes reference to health in the following policies: Policy LP9: Health and Wellbeing: this states that the potential for achieving positive and physical health outcomes will be taken into account when considering all development proposals; Policy LP13: Accessibility and Transport: this states that development proposals should contribute towards an efficient and safe transport network, where the use of sustainable transport modes are maximised; Policy LP15: Community Facilities: this states that all development proposals should recognise the community facilities as an integral component in achieving and maintaining sustainable, well integrated and inclusive development; Policy LP18. Climate Change and Low Carbon Living: this states that development proposals will be considered more favourably if the scheme would make a positive and significant contribution towards	Provides local policy context for the consideration of health and wellbeing in the population likely to be affected by the Project. An assessment of the health and wellbeing impacts arising from the Project on local populations, including neighbourhood amenity and access to local facilities, is shown in **Section 24.8.**

Legislation/Policy/Guidance	Consideration within the ES
one or more of the following: reducing demand; resource efficiency; energy production; and carbon off-setting; Policy LP19: Renewable Energy Proposals: this states that proposals for non-wind renewable technology will be assessed on their merits, with the impacts considered against the benefits of the Scheme; and Policy LP20: Green Infrastructure Network: this states that the Central Lincolnshire Authorities will aim to maintain and improve the green infrastructure network by enhancing, creating and managing multifunctional green space within and around settlements that are well connected to each other and the wider countryside.	

24.4 Assessment Methodology

Methodology

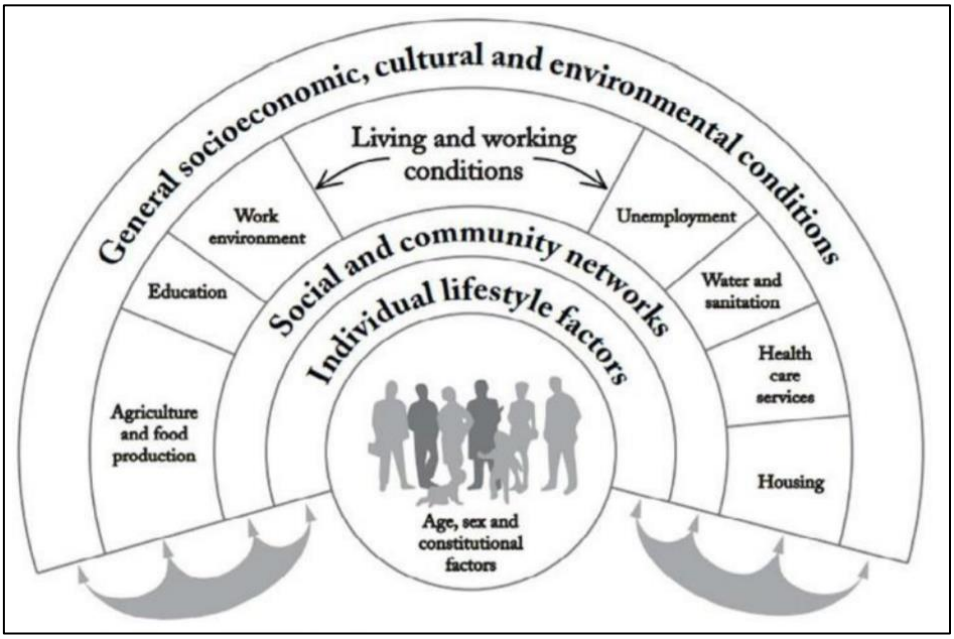
24.4.1 The IEMA guidance "Determining Significance For Human Health in Environmental Impact Assessment" forms the basis of the approach adopted to assess impacts on human health in this chapter (Ref 24-1). Consideration has also been given to supplementary IEMA guidance "Effective Scoping of Human Health in Environmental Impact Assessment" (Ref 24-14). In addition, consideration has been given to NHS England's HUDU Rapid Health Impact Assessment ("HIA") Toolkit 2019 (Ref 24-15) to assist with the identification of relevant health determinants and mapping of health pathways.

24.4.2 The World Health Organisation ("WHO") Europe defines health as a '*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*' (Ref 24-21). Public health therefore encompasses general wellbeing, not just the absence of illness.

24.4.3 The health and wellbeing of individuals is determined by a broad range of individual constitutional and behavioural factors (or "determinants"), as well as broader environmental, social and economic factors. Some factors are direct and obvious, others are indirect.

24.4.4 Dahlgreen and Whitehead's model of the main determinants of health (Ref 24-22) illustrates the breadth of possible influences on health, as shown in **Plate 24-1**. At the centre of the illustration are factors that are largely fixed – including individual age, sex, constitutional and genetic factors. Outside of this are factors generally described as the wider or broader determinants of health. The model emphasises interactions between the layers. Moving outwards from the centre, individual lifestyle choices are embedded in social norms and community networks, and in living and working conditions, which in turn are shaped by and related to the wider socio-economic and cultural environment.

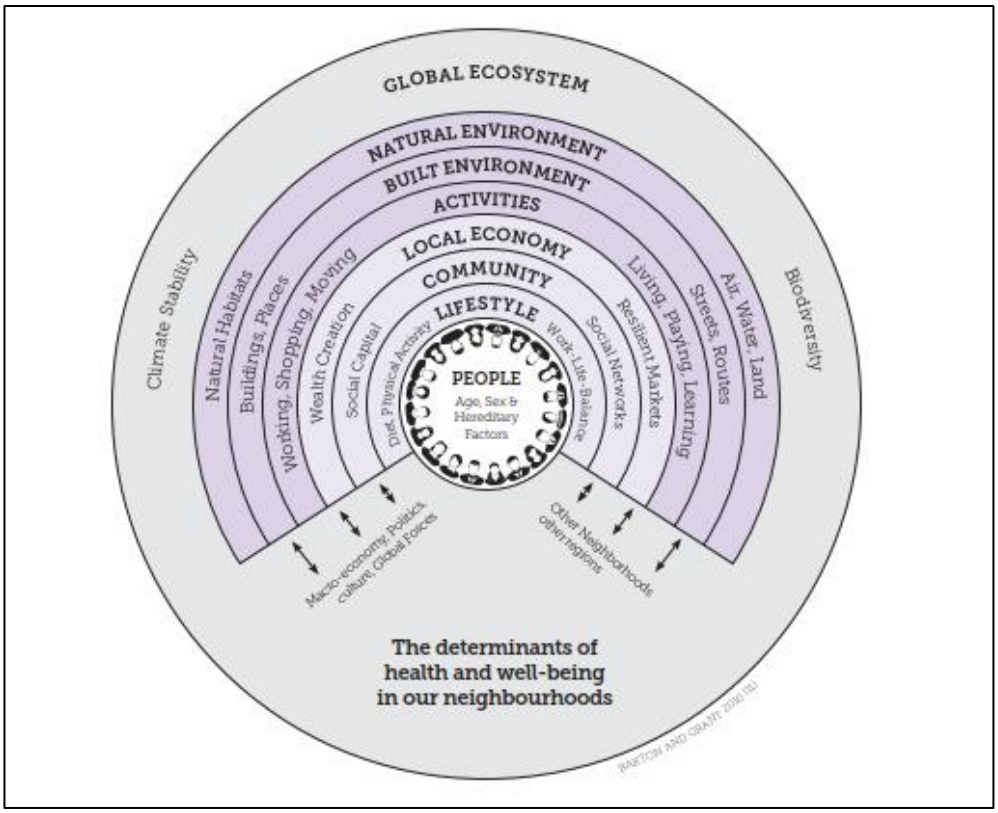
Plate 24-1: Determinants of health



Source: Ref 24-22

24.4.5 This model has been developed to show elements of the built environment and communities that are the most significant determinants of health, as shown in **Plate 24-2.**

Plate 24-2: Determinants of health and wellbeing in neighbourhoods



Source: Ref 24-23

24.4.6 Within a population there can also be health inequalities, defined by the WHO as '*differences in health status or in the distribution of health determinants between different population groups. For example, differences in mobility between elderly people and younger populations or differences in mortality rates between people from different social classes'* (Ref 24-21).

24.4.7 This qualitative[2] assessment of human health effects considers the following health and wellbeing determinants of relevance to the Project:

a. Access to healthcare services and other social infrastructure.

b. Emissions of dust, noise, vibration, and odours.

c. Air/noise pollution linked with traffic.

d. Accessibility to PRoW, open space, and on active travel.

e. Access to employment and training, particularly for local residents.

[2] The assessment of human health and wellbeing is qualitative in its conclusions of assigning significance of effect on determinants. However, it should be noted that some of the information used is derived from other assessments within this ES which are based on quantitative assessment methodologies. The human health and wellbeing assessment therefore inherently considers qualitative and quantitative information to inform a qualitative conclusion. This is an appropriate approach as detailed within the IEMA guidance (Ref 24-1).

f. Contribution to social cohesion and engagement with existing communities to encourage social interaction and support mental health, including perception of risk.

g. Climate change.

24.4.8 **Table 24-3** sets out a summary of the health determinants scoped into this assessment, and the source, pathway, and receptor links relevant to each.

Table 24-3: Health determinants: Source-Pathway-Receptor links

Determinant	Source	Pathway	Receptor	Project phase
Access to healthcare and other social infrastructure	Potential changes to access to healthcare arising from temporary or permanent closures, diversions or amenity impacts on PRoW or impacts on the local road network	Potential adverse impact on access to health services which could impact human health	Human receptors living within local communities	Construction, operation and decommissioning
	Potential changes to access to healthcare arising from an influx of workers to the local area	Potential adverse impact on access to health services due to effects of levels of provision resulting from additional workforce in the local area	Human receptors who use local healthcare services	Construction, operation and decommissioning
Emissions of dust, noise, vibrations and odours	Potential temporary changes in local air quality including increased dust and particulate matter emissions arising from the construction and decommissioning of the Project	Potential adverse human health impacts arising from increased exposure to dust and particulate matter emissions arising from the Project	Human receptors likely to be at risk of possible direct and indirect air quality impacts from the Project	Construction and decommissioning
	Potential temporary or permanent changes in noise levels arising from the construction and	Potential adverse human health impacts arising from increased exposure to noise due to the Project	Human receptors likely to be at risk of possible direct and indirect noise impacts from the Project	Construction and decommissioning

Determinant	Source	Pathway	Receptor	Project phase
	decommissioning of the Project			
Air/noise pollution linked with traffic	Potential temporary or permanent increases in traffic on the local road network	Potential adverse impacts on air quality and noise conditions, which could impact human health	Human receptors in the vicinity to the local road network	Construction, operation and decommissioning
Accessibility to open space, and on active travel	Potential changes to community connectivity and wider community services including open space arising from temporary or permanent closures, diversions or amenity impacts on public rights of way PRoW or impacts on the local road network	Potential adverse impacts on journeys made by active travel modes, and access to open spaces which could impact human health	Human receptors living within local communities	Construction and decommissioning
Access to employment and training	Potential temporary or permanent increase in employment and training opportunities, directly related to the Project, or within the wider supply chain	Potential beneficial economic impacts arising from employment, training and income opportunities for those working on the Project, or within the wider supply chain, which could impact human health	Human receptors who could potentially benefit from employment and training opportunities, directly related to the Project, or within the wider supply chain	Construction, operation and decommissioning
Contributions to social cohesion including perception of risk	Potential temporary or permanent changes to social cohesion including impacts on mental health and the perception of risk	Potential adverse impacts on human health resulting from disruption to community connectivity, or increases in perception of risk	Human receptors in communities near to the Project	Construction, operation and decommissioning

Determinant	Source	Pathway	Receptor	Project phase
		leading to mental health issues		
Climate change	Potential temporary or permanent changes to Greenhouse Gas (GHG) emissions	Potential human health impacts arising from increased exposure to GHG emissions arising from the Project	Human receptors likely to be exposed to increased or reduced GHG emissions arising from the Project	Construction and operation

24.4.9 The assessment has considered the potential consequences for health and wellbeing arising from construction, operation and decommissioning phases of the Project and draws upon the information and conclusions reported within the air quality assessment (**Chapter 6: Air Quality [TR030008/APP/6.2]**), noise and vibration assessment (**Chapter 7: Noise and Vibration [TR030008/APP/6.2]**), traffic and transport assessment (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**), climate change assessment (**Chapter 19: Climate Change [TR030008/APP/6.2]**), and socio-economic assessment (**Chapter 23: Socio-economics [TR030008/APP/6.2]**).

24.4.10 The assessment of human health considers the residual effects as reported in these chapters. The human health assessment therefore inherently takes into account the standard, embedded, and additional mitigation measures of the respective assessments, which are set out in further detail in **Section 24.7** of this chapter.

24.4.11 The following human health determinants assessed within other technical assessments across this ES report have been scoped out of the human health assessment, as measures have been established to manage risk and ensure effects on human health are unlikely. These aspects have been monitored during the preparation of the ES, and where potential health effects are identified these have been considered in the human health assessment as relevant:

a. Water quality or availability **(Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]).**

b. Land quality **(Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]).**

c. Community safety **(Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]).**

24.4.12 An assessment of the risks associated with EMF has been included in the human health assessment. This has been included in order to fully respond to Scoping Opinion response from UK Health Security Agency/OHID. The assessment is based on advice provided by the UK Health Security Agency within their Scoping Opinion response (see **Table 24-1**). Additionally, the Electric and Magnetic Fields website has been used to gather information on the EMF risks associated with the types of infrastructure proposed (Ref 24-24). International Commission on Non-ionising Radiation Protection (“ICNIRP”) guidelines, in line with government

policy, have been used as a reference for the recommended limits of exposure of the general public to EMFs (Ref 24-25).

24.4.13 The assessment of potential EMF related effects does not follow the 'standard' Environmental Impact Assessment ("EIA") methodology of identifying the sensitivity of receptors and magnitude of impacts to classify the effect using a matrix. The former Department for Energy and Climate Change (("DECC"), now Department for Energy Security and Net Zero) Voluntary Code of Practice on compliance with EIA guidelines (Ref 24-26) advises that the Energy Networks Association ("ENA") will maintain a publicly available list of types of equipment which comply with the ICNIRP exposure guidelines. The methodology requires that all human receptors located within the potential electrical field are identified and, with reference to the identified impact avoidance measures, effects are qualitatively either considered to be significant or not significant, based on professional judgement.

Sources of Information

24.4.14 This chapter presents the assessment of the potential human health and wellbeing effects of the Project against the current human health baseline conditions (as determined at the time of publication of latest available data) within the study areas set out **Section 24.5** below.

Desktop survey

24.4.15 In order to understand the existing population health baseline, data illustrating the existing population health conditions has been collected through a desk-based research exercise using publicly available sources, documents and web-based applications.

24.4.16 Sources of information that have been used for this exercise include:

a. Office for National Statistics, (2022); Census 2021 (Ref 24-27).

b. Ministry of Housing, Communities and Local Government, (2019); Indices of deprivation (Ref 24-28).

c. Office for Health Improvements and Disparities, (2022); Local Authority Health Profiles (Ref 24-29)

d. Public Health England, (2015); Modelled Prevalence Estimates (Ref 24-30).

e. NHS Digital, (2023); General Practice Workforce (April 2023) (Ref 24-31).

Impact Assessment Methodology

24.4.17 The human health and wellbeing assessment was scoped in line with NHS England's HUDU *Rapid HIA Toolkit 2019* (Ref 24-15). This informed the identification and scoping of relevant determinants of health to be assessed. Although this guidance represented best practice principles at the time of scoping the assessment, no industry-recognised guidance for assigning significance of human health and wellbeing effects for the purposes of EIA was available.

24.4.18 IEMA guidance on health impact assessment has since been released which provides additional best practice principles that enable a robust assessment of the significance of human health and wellbeing effects for the purposes of EIA (Ref 24-1 and Ref 24-14). In order to incorporate this recently released guidance, and to address statutory consultation feedback regarding the methodology, the assessment in this chapter of the ES follows IEMA guidance to assign significance to human health effects.

24.4.19 The potential effects/health determinants identified at scoping have also been reviewed against the since published wider determinants of health given by IEMA to ensure alignment with this recognised guidance. To do this, the scoped in determinants have been compared against those in the IEMA guidance. This is shown in **Table 24-4**.

24.4.20 As a result of this exercise, it is deemed appropriate to retain the HUDU determinants as originally identified as they are seen to comply and align well with wider determinants of health given by IEMA guidance.

Table 24-4: Health determinants assessed

Assessment determinants	IEMA determinants covered
Access to healthcare and other social infrastructure	• Health and social care services • Community safety • Community identity, culture, resilience and influence • Physical activity • Diet and nutrition • Water quality or availability
Emissions of dust, noise, vibration and odours	• Air quality • Noise and vibration • Housing • Relocation • Land quality
Air/noise pollution linked with traffic	• Air quality • Noise and vibration • Physical activity • Transport modes, access and connections • Community safety

Assessment determinants	IEMA determinants covered
Accessibility to open space, and on active travel	• Open space, leisure, and play • Risk-taking behaviour • Transport modes, access and connections
Access to employment and training	• Education and training • Employment and income
Contributions to social cohesion	• Social participation, interaction and support • Built environment • Wider societal infrastructure and resources • Community safety • Community identity, culture, resilience and influence
Climate change	• Climate change mitigation and adaptation

24.4.21 The human health and wellbeing assessment follows the general impact assessment methodology set out in **Chapter 5: EIA Methodology [TR030008/APP/6.2]**. The specific magnitude and sensitivity criteria applied for the human health assessment are set out below, and reflect IEMA guidance, *Determining Significance for Human Health in EIA* (Ref 24-1).

24.4.22 For human health there is no accepted definition of what constitutes a significant (or not significant) effect. It is, however, recognised that effects are categorised based upon the relationship between the magnitude of effect and the sensitivity of the affected human receptor. As such the significance criteria of human health effects has been assessed based on expert judgement and professional experience of the author, and relies on the following considerations:

a. **Sensitivity of human health receptors including general populations and potentially vulnerable sub-populations**: specific values in terms of sensitivity are not attributed to population health due to the diverse range of determinants and indicators that can determine overall health. However, the assessment takes account of the qualitative (rather than quantitative) sensitivity of relevant populations and their likely ability to adapt to change.

b. **Magnitude of impact**: this entails consideration of: the scale of the exposure of the population to an impact; whether the impact is one-off or continuous; the likely nature of the human health impact; the permanence of the change; and, the proportion of the relevant study area population that would be affected.

24.4.23 The assessment aims to be objective and quantifies effects as far as possible. However, some effects can only be evaluated on a qualitative basis. Effects are defined as follows:

a. **Beneficial** classifications indicate an advantageous or beneficial effect on human health, which may be minor, moderate or major in significance.

b. **Adverse** classifications indicate a disadvantageous or adverse effect on human health, which may be minor, moderate or major in significance.

c. **Negligible** classifications of effect indicate imperceptible effects on human health.

d. **No effect** classifications of effect indicate that there are no effects on human health.

24.4.24 The geographical scales considered to assess significance for each human health effect considered are described in **Section 24.5**.

24.4.25 Duration of effect is also considered, with more weight given to longer-term or permanent changes than to shorter-term or temporary ones.

Sensitivity of receptor

24.4.26 Sensitivity of population health is driven by a number of factors which are set out in **Table 24-5**, and are based on guidance set out by IEMA guidance, *Determining Significance for Human Health in EIA.*

Table 24-5: Human health sensitivity criteria

Sensitivity level	Sensitivity criteria
High	High levels of deprivation (including pockets of deprivation); reliance on shared resources (between the population and the Project); existing wide inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or concern; people who are prevented from undertaking daily activities; dependents; people with very poor health status; and/or people with a very low capacity to adapt
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening inequalities between the most and least healthy; a community whose outlook is predominantly uncertainty with some concern; people who are highly limited from undertaking daily activities; people providing or requiring a lot of care; people with poor health status; and/or people with a limited capacity to adapt
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care; people with fair health status; and/or people with a high capacity to adapt

Sensitivity level	Sensitivity criteria
Very low	Very low levels of deprivation; no shared resources; existing narrow inequalities between the most and least healthy; a community whose outlook is predominantly support with some concern; people who are not limited from undertaking daily activities; people who are independent (not a carer or dependent); people with good health status; and/or people with a very high capacity to adapt.

Source: Adapted from: IEMA, (2022); IEMA Guide to Determining Significance for Health (Table 7.1) (Ref 24-1).

Magnitude of impact

24.4.27 Magnitude of impact is driven by a number of factors which are set out in **Table 24-6**:, based on guidance set out by IEMA guidance, *Determining Significance for Human Health in EIA* (Ref 24-1).

Table 24-6: Human health magnitude of impact criteria

Magnitude level	Magnitude criteria
High	High exposure or scale; long-term duration; continuous frequency; severity predominantly related to mortality or changes in morbidity (physical or mental health) or very severe illness/injury outcomes; majority of population affected; permanent change; substantial service quality implications
Medium	Low exposure or medium scale; medium-term duration; frequent events; severity predominantly related to moderate changes in morbidity or moderate change in quality of life; large minority of population affected; gradual reversal; small service quality implications
Low	Very low exposure or small scale; short-term duration; occasional events; severity predominantly related to minor change in morbidity or moderate change in quality of life; small minority of population affected; rapid reversal; slight service quality implications
Very low	Negligible exposure or small scale; very short-term duration; one off frequency; severity predominantly relates to minor change in quality of life; very few people affected; immediate reversal once activity complete; no service quality implications.

Source: Adapted from: IEMA, (2022); IEMA Guide to Determining Significance for Health (Table 7.2) (Ref 24-1).

Significance of effects

24.4.28 Human health effects reflect the relationship between the sensitivity of the relevant population health, and the magnitude of the impact, as set out in **Table 24-7**:

Table 24-7: Impact assessment and significance of effect

Magnitude of Impact	Sensitivity of Receptor			
	High	Medium	Low	Very low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very low	Minor	Negligible	Negligible	Negligible

24.4.29 In accordance with the methodology set out in **Chapter 5: EIA Methodology [TR030008/APP/6.2]**, the following criteria is applied:

a. 'Moderate' or 'Major' effects are classed '**significant'**.

b. 'Minor' effects are classed as '**not significant**'.

c. 'Negligible' effects are classed as '**not significant**'.

Stakeholder Engagement

24.4.30 A range of stakeholders have been engaged as part of the scoping process to obtain their views on the Project and the scope of the human health and wellbeing assessment, the results of which are presented within the Scoping Opinion (**Appendix 1-A [TR030008/APP/6.4]**). Moreover, consultees were also engaged to obtain views on the findings of the PEI Report, and those views have been taken into account with regard to the ongoing human health and wellbeing assessment.

Limitations and Assumptions

24.4.31 This assessment is based on baseline conditions obtained and evaluated at timeframes set out in the relevant chapters which inform the assessment, and Project design parameters set out in Section 2.3 of **Chapter 2: The Project [TR030008/APP/6.4]** of this ES.

24.4.32 The assessment of likely human health effects has been carried out against a benchmark of current human health and wellbeing baseline conditions prevailing around the Project, as far as is possible within the limitations of such a dataset. Baseline data is subject to a time lag between collection and publication. As with any dataset, these conditions may be subject to change over time which may influence the findings of the assessment. Baseline conditions reported in **Section 24.6** regarding human health and wellbeing are based on latest data available at the time of writing.

24.4.33 This assessment is based on professional judgement and considers both the adverse and beneficial impacts that the Project will have on the surrounding receptors. It provides an indication of human health and wellbeing effects on people and the local community.

24.4.34 Effects of human health and wellbeing during the construction, operation and decommissioning phases are based on assessments taking into consideration the results from the relevant environmental studies. These studies comprise **Chapter 6: Air Quality, Chapter 7: Noise and Vibration**, **Chapter 11: Traffic and Transport**, **Chapter 19: Climate Change**, and **Chapter 23: Socio-economics [TR030008/APP/6.2]**.

24.4.35 The transport assessment (as set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**) presents information obtained and evaluated at the time of reporting and is based on the proposed parameters for the Project and the maximum extents of land required for its construction and operation. The assessment is based on conservative assumptions in accordance with the Rochdale Envelope approach, and the assessment is based on the worst-case assumption of a peak construction commencing in 2026. The traffic data used for the assessment is based on secondary data from surveys undertaken on behalf of the Applicant as part of the proposed Immingham Eastern Ro-Ro Terminal development and an Automated Traffic Count ("ATC") undertaken on week commencing 5 January 2023. HGV construction vehicles are assumed to travel to and from the Site via the A1173 towards the A180 where they are distributed based upon existing patterns of movements. The assessment does not include the opening year of the Project due to the worst-case year being assessed. The assessment also does not include the decommissioning phase, owing to it being scoped out by agreement with the Planning Inspectorate ("The Inspectorate").

24.4.36 The noise and vibration assessment methodology set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]** is based on the maximum likely extent of land required for the Project construction, operation and subsequent decommissioning (of the hydrogen production facilities alone). The Rochdale Envelope approach has been adopted, with the location of operational plant within the areas shown for the relevant Work Nos on the Works Plans assessed on the basis of the "reasonable worst-case scenario" for the Noise Sensitive Receptors ("NSRs"). Detailed information about the construction methods and plant requirements is not yet available, however the assessment is based on construction plant which is likely to be used and professional judgement and is therefore considered robust. Furthermore, detailed traffic predictions are not yet available. The construction and operational traffic noise assessment is based on the 18 AAWT traffic data provided in the relevant assessment.

24.4.37 The air quality assessment methodology set out in **Chapter 6: Air Quality [TR030008/APP/6.2]** is informed by the traffic data set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** and is to that extent subject to the limitations and assumptions within that chapter (see also above). The assessment is informed by onsite emissions source characteristics and data provided by the Project design team. Vessel emissions data is also provided by the Project design team. It is impossible to estimate the proportion of Tier II and Tier III vessels using the facility in 2028 or 2036, but it is a certainty that all vessels will be Tier II compliant as a minimum. Meteorological data has been sourced from the nearest and most representative monitoring site which is 13km from the Site. Due to inter-annual variation in meteorological conditions, five years of data have been used in modelling to account for that variability.

Department for Environment, Food & Rural Affa background data and Air Pollution Information Service ("APIS") background data has been used to represent background pollutant concentration data in the study area, and it is considered proportionate and not unreasonable that background concentrations have not had any sources removed and are therefore considered to include emissions associated with the neighbours of the Site.

24.4.38 The climate change assessment methodology pertaining to lifecycle greenhouse gas ("GHG") emissions assessment set out in **Chapter 19: Climate Change [TR030008/APP/6.2]** details that the assessment is based on assumptions regarding the materials used. Moreover, there is no guidance which gives quantified thresholds of carbon emissions which would result in a significant effect. Additionally, a number of quantitative assumptions were made for the purposes of calculating GHG emissions.

24.4.39 This assessment has also considered the socio-economic assessment which has been carried out against a benchmark of current socio-economic baseline conditions prevailing around the Project, as far as is possible within the limitations of such datasets, as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**. Baseline data is subject to a time lag between collection and publication and, as with any dataset, these conditions may be subject to change over time which may influence the findings of the assessments. Construction and operational employment figures have been based on assessment of anticipated employment figures, as determined by the Applicant, and subject to subsequent analysis of resulting indirect employment in line with appropriate guidance. With regard to PRoW, it is assumed that Public Footpath 32 (which is not in active use and abuts the boundary) will not be affected by the Project as the only relevant work in this area is the underground pipeline corridor which it is assumed will be constructed using Horizontal Directional Drilling. Public Bridleway 36, which runs north from Laporte Road to the Humber, along the east edge of the Long Strip woodland will be temporarily partially closed and diverted during the first phase of the construction phase of the Project as shown on the **Stopping Up and Restriction of Use of Streets and Public Rights of Way Plan [TR030008/APP/4.7]**. During this temporary diversion, recreational sea anglers, including any clubs, will no longer have access along the sea front shown in the area of **Figure 23-6 [TR030008/APP/6.3]**, although once Public Bridleway 36 reopens on its original alignment it is anticipated that access for sea anglers will be possible along the sea front, up to the point where Public Bridleway 36 enters the Long Strip woodland (see **Figure 23-1 [TR030008/APP/6.3]**). With regard to private assets within the Site Boundary, it is assumed that residential use of a number of residential or mixed residential/ commercial properties (ten residential units in total) will cease permanently before the commencement of the construction phase and that these properties will be acquired through agreement or using compulsory acquisition powers). Two of those properties include business premises at ground floor (7-8 Queens Road and 18 Queens Road) and will also be acquired, such that a loss of commercial floorspace is assumed. Other businesses adjacent to the Site Boundary are considered to be compatible with operation of the facility and will be able to trade during all phases of the Project. It is recognised that there is

potential for a cumulative effect on labour force availability if the construction period coincides with other Nationally Significant Infrastructure Projects ("NSIPs") in the Yorkshire and Humber region.

24.4.40 The temporary impacts during construction are assessed as occurring simultaneously and for the duration of the programme set out in **Chapter 2: The Project [TR030008/APP/6.2]**. The same approach is assumed for decommissioning for the terrestrial parts of the Project. Whilst there is a phased construction programme across the 11 year construction period, the likely 'worst case' is assessed reflecting the approach to this adopted in the relevant environmental studies considered as part of the human health and wellbeing assessment. This may result in the overestimate of predicted adverse health effects but is considered a robust approach to the assessment. Should the construction phase be extended or delivered in phases, as set out in **Chapter 2: The Project [TR030008/APP/6.2]**, the predicted effects would be the same or less than those outlined in the chapter.

24.4.41 It is assumed that the main elements of the Terminal (the jetty, jetty head, loading platforms and access ramps and the jetty access road) would become part of the long- term port infrastructure and would not be decommissioned. Decommissioning of the terrestrial elements of the Project (the hydrogen production facility comprised in the Associated Development) and the plant and equipment on the jetty topside is assessed as occurring after 25 years of operation and for the purposes of this assessment is treated as taking place no earlier than 2060, based on a 25-year design life. It is also possible that the hydrogen production facility will be operational for a longer period of time and or that certain elements of it may be decommissioned in advance of the main decommissioning phase and then the predicted effects would be the same or less than those outlined in this chapter.

24.5 Study Area

24.5.1 The study areas for the assessment of potential human health effects, as set out in **Table 24-8**, have been defined to include human populations likely to be at risk from the possible direct and indirect health impacts that might arise from the Project. The study areas for human health are therefore based on the extent and characteristics of the Project, and the populations assessed to be likely to be directly and indirectly affected by it.

24.5.2 The study areas therefore vary by the type of impact being assessed:

a. The population health profile baseline study area comprises a local ward area including the four local wards which the Project is located in or in close proximity to. This comprises: Immingham, and Wolds wards in North East Lincolnshire, Ferry in North Lincolnshire; and Yarborough in West Lindsey[3]. Where data is not available at the ward level, local authority level data is provided for North East Lincolnshire, North Lincolnshire, and West Lindsey.

b. The study areas for potential human health impacts arising from impacts on community connectivity, and access to healthcare services and other facilities, including human receptors that could be impacted by community severance or access impacts arising from the Project are as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]** which includes human receptors residing or working within 500m of the Site, visiting community facilities within 1.5km of the Site, or accessing primary healthcare within 5km of the Site. As detailed in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, this study area also takes into account the immediate road network and the route to the Strategic Road Network as set out in paragraph 11.5.3.

c. The study area for potential human health impacts arising from impacts on prioritisation of walking and cycling includes human receptors that could be at risk from possible direct and indirect impacts on access to PRoW or impacts arising from increased traffic on the local road network. As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, this includes human receptors accessing PRoW within 500m of the Project, and as set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, human receptors in the vicinity of the traffic and transport study area (comprising the immediate network and the route to the Strategic Road Network) including the A180 and along the A1173 and relevant road links, as set out in paragraph 11.5.3.

d. The study area for potential human health impacts arising from access to employment and training includes human receptors that could benefit from local economic and employment impacts. As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, this includes human receptors within North East Lincolnshire.

e. The study area for potential human health impacts arising from air quality impacts includes human receptors that could be impacted by construction phase dust or particulate matter, or emissions generated by construction road traffic. As set out in **Chapter 6: Air Quality [TR030008/APP/6.2]**, this includes human receptors within 350m of the Site Boundary and/or 50m of a public road used by construction vehicles that is within 500m of a site access

[3] Depending on the human health indicator being analysed, ward level data is available from the 2011 Census wards or 2018 electoral wards. Whilst the geographical extent of the 2011 Census and 2018 electoral wards differ, both extents provide an indication of local health in proximity to the Project and are therefore considered suitable for assessing the existing baseline conditions for human health. Where ward level data is not available, the local authorities of North Lincolnshire, West Lindsey, and North East Lincolnshire have been used as the study area referenced in the text.

point, and where there are sensitive ecological receptors within 50m of the Site Boundary and/or 50m of a public road used by construction vehicles that is within 500m of a site access point. The study area also includes human receptors within 200m of an 'affected' road link as set out in paragraphs 6.5.3 and 6.5.4.

f. The study area for potential human health impacts arising from noise and vibration impacts as set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**, includes during the construction phase NSR's up to 300m from the Site Boundary (including NSRs on Queens Road) and, for completeness, residential receptors approximately 460m – 500m from the Site Boundary at the south-eastern edge of Immingham. During the operation phase, the study area includes NSRs up to approximately 500m from the Site Boundary (excluding residential NSRs on Queens Road), including the residential NSRs at the south-eastern edge of Immingham. Additionally, for the assessment of changes in road traffic noise, this study area includes NSRs within 50m of the roads which would be used by vehicles during the construction and operation activities (NSRs on Queens Road will be considered where appropriate and applicable).

g. The study area for potential human health impacts arising from climate change impacts includes human receptors that could by impacted by changes in GHG emissions. As set out in **Chapter 19: Climate Change [TR030008/APP/6.2]**, with respect to GHG emissions, this includes human receptors globally given the potential global locations from which construction materials will be sources, and as the effects of GHG emissions are not geographically constrained.

Table 24-8: Summary of potential human health impacts and study areas

Potential Impact	Study Area	Rationale for Study Area
Potential adverse impacts on community participation and interaction, and access to open spaces which could impact human health	Human receptors residing or working within 500m of the Site Visitors of community facilities within 1.5km of the Site Users of primary healthcare facilities within 5km of the Site Human receptors in the vicinity of the immediate road network and route to the Strategic Road Network	Study area includes human receptors that could be affected by impacts on PRoW or the local road network as a result of the Project, as set out in **Chapter 23: Socio-economics** and **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.
Potential adverse impacts on journeys made by active travel modes, which could impact human health	Users of ProW within 500m of the Site	Study area includes human receptors that could be affected by impacts on ProW or the local road network as a result of the Project, as set out in **Chapter 23: Socio-economics**

Potential Impact	Study Area	Rationale for Study Area
	Human receptors in the vicinity of the HGV route to the Strategic Road Network	and **Chapter 11: Traffic and Transport [TR030008/APP/6.2].**
Potential beneficial economic impacts arising from employment, training and income opportunities for those working on the Project, or within the wider supply chain, which could impact human health	North East Lincolnshire	Study area includes human receptors that could benefit from potential local economic and employment impacts, as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**.
Potential human health impacts arising from increased exposure to GHG emissions arising from the Project	Globally	Study area includes human receptors that could be impacted by changes in exposure to GHG emissions as a result of the Project, as set out in **Chapter 19: Climate Change [TR030008/APP/6.2]**.
Potential adverse human health impacts arising from increased exposure to dust and particulate matter emissions arising from the Project	350m from Site boundary and/or 50m from public road used by construction traffic (within 500m of site access point) 200m from an 'affected' road link	Study area includes human receptors that could be impacted by construction phase dust or particulate matter, or emissions generated by construction road traffic, as set out in **Chapter 6: Air Quality [TR030008/APP/6.2]**.
Potential adverse human health impacts arising from increased exposure to noise due to the Project	NSRs within 500m of Site boundary; or 50m of roads used by construction and operation vehicles	Study area includes NSRs that could be impacted by noise and vibration impacts, as set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**.
Potential adverse impact on access to health services which could impact human health	Users of primary healthcare facilities within 5km of the Site Human receptors in the vicinity of the immediate road network and route to the Strategic Road Network	Study area includes communities and road users that could be affected by severance or access impacts, or journey delay, as set out in **Chapter 23: Socio-economics** and **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**.

24.6 Baseline Conditions

Current Baseline

24.6.1 This section describes the human health baseline environmental conditions within the human health and wellbeing study area, compared, where relevant, to wider geographical areas of the Yorkshire and the Humber region and England and Wales as a whole[4].

24.6.2 'Current baseline' in the context of this data is taken to reflect the conditions at the time of publication of the data sources referenced. It is deemed appropriate that the latest available and robust datasets are referenced, as these are considered to represent the baseline conditions most accurately. This is subject to the assumptions and limitations referenced in **Section 24.4**.

Demographic profile

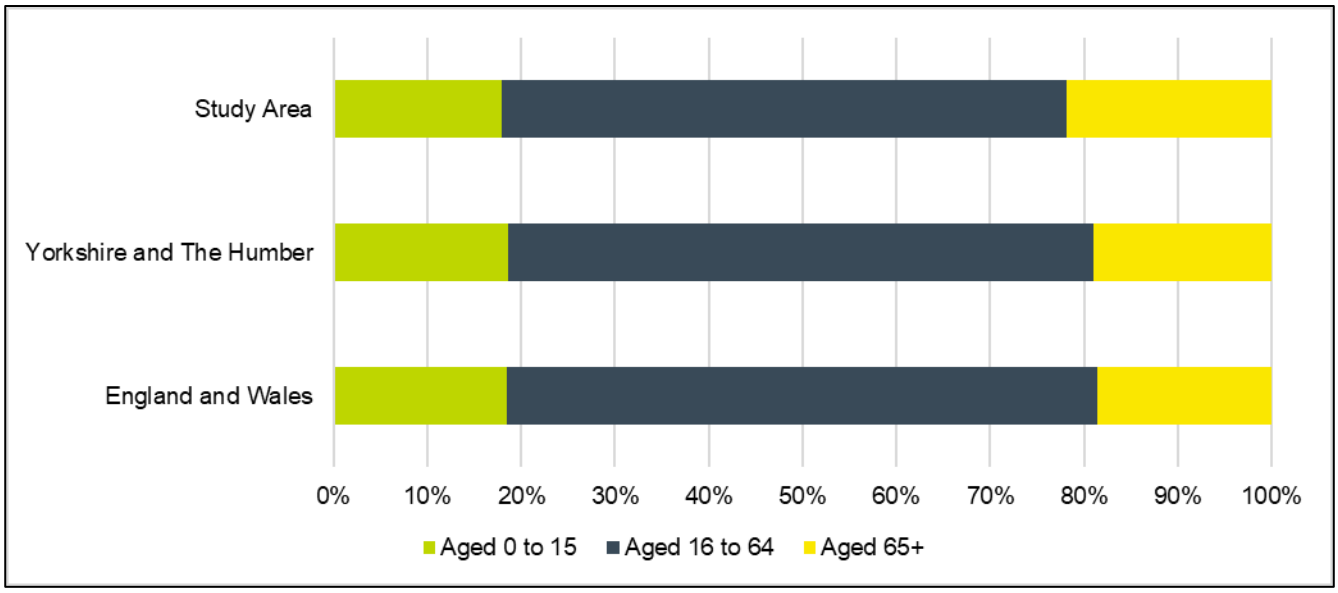
24.6.3 The total population of the study area, according to latest Census data, is 42,508, comprised of 11,428 in Ferry, 11,669 in Immingham, 7,789 in Wolds, and 11,622 in Yarborough (Ref 24-27).

24.6.4 In 2021, the proportion of working age residents (aged 16 to 64) in the study area was 60.3% which is slightly lower than is typical for the Yorkshire and The Humber region (62.4%) and across England and Wales as a whole (62.9%). This is shown in **Plate 24-3.**

24.6.5 Additionally, the average proportion of residents aged 65 and over in the study area is 21.8%, which is slightly greater than is typical for the Yorkshire and The Humber region (19.0%) and across England and Wales as a whole (18.6%).

[4] Data for the Yorkshire and the Humber region is presented for comparison purposes, and in order to contextualise the study area data, and thus does not form part of the assessment.

Plate 24-3: Age Breakdown by Geography



Source: Office for National Statistics, (2022); Census 2021 (Ref 24-27).

24.6.6 The proportion of residents who self identify as of White ethnicity within the study area (97.5%) is far greater than is typical for the Yorkshire and The Humber region (85.4%), and across England and Wales (81.7%). Accordingly, the proportion of residents of other ethnic groups is below the equivalent regional and national rate. For example, whereas Asian/Asian British/Asian Welsh residents comprise 0.9% of the study area population, this ethnic group represents 8.9% of the population of the Yorkshire and Humber region, and 9.3% of the population of England and Wales. A breakdown of self-identified ethnicity within the study area, and regional and national averages is shown in **Table 24-9** (Ref 24-27).

Table 24-9: Ethnic group by geography

Ethnic Group	Study Area	Yorkshire and The Humber region	England and Wales
Asian, Asian British or Asian Welsh	0.9%	8.9%	9.3%
Black, Black British, Black Welsh, Caribbean or African	0.2%	2.1%	4.0%
Mixed or Multiple ethnic groups	0.8%	2.1%	2.9%
White	97.5%	85.4%	81.7%
Other ethnic group	0.5%	1.4%	2.1%

Source: Office for National Statistics, (2022); Census 2021 (Ref 24-27).

Deprivation

24.6.7 The 2019 Indices of Deprivation (Ref 24-28) provide a set of relative measures of deprivation for local authorities and Lower Super Output Areas ("LSOAs")[5] across England. The indices are comprised of a number of sub-domains of deprivation, including 'health'. An overall indication of deprivation of an area, appreciating all domains, is also reported. The local authorities which are included in the study area are North East Lincolnshire, North Lincolnshire and West Lindsey. North East Lincolnshire is the 66th most deprived local authority of 317 in England (where 1st is most deprived). North Lincolnshire is the 120th most deprived in England. West Lindsey is the 146th most deprived local authority in England.

24.6.8 Further detailed breakdown of indices of deprivation in each of the considered local authorities is given in **Table 24-10**. This shows that, in terms of overall deprivation, half of the LSOAs within North East Lincolnshire are ranked amongst the 30% most deprived LSOAs nationally. In North Lincolnshire the incidence of overall deprivation is lower as only approximately 30% (28%) of LSOAs are ranked among the 30% most deprived nationally. In West Lindsey 24% of LSOAs are ranked among the 30% most deprived nationally.

24.6.9 Information is also provided in **Table 24-10** below regarding the incidence of deprivation in the health domain. It is shown that there is a high incidence of deprivation in the health domain in North East Lincolnshire whereby almost half (47%) of all LSOAs rank amongst the 30% most deprived LSOAs nationally. The equivalent incidence of deprivation in the health domain in North Lincolnshire is lower, whereby only 32% of LSOAs rank among the 30% most deprived nationally. In West Lindsey approximately 23% of LSOAs rank among the 30% most deprived nationally.

Table 24-10: Indices of deprivation

Decile	Relative Deprivation	North East Lincolnshire		North Lincolnshire		West Lindsey	
		Overall Index of Depriv-ation	Health domain	Overall Index of Depriv-ation	Health domain	Overall Index of Depriv-ation	Health domain
0-10%	Most deprived	30%	15%	11%	11%	8%	4%
10-20%	↑	8%	17%	9%	8%	10%	0%
20-30%		12%	15%	8%	13%	6%	17%
30-40%		8%	10%	9%	12%	10%	13%

[5] Lower Layer Super Output Areas (LSOAs) are small geographical units designed to improve the reporting of small area statistics in England and Wales. Lower Layer Super Output Areas are built from groups of contiguous Output Areas and have been automatically generated to be as consistent in population size as possible.

Decile	Relative Deprivation	North East Lincolnshire		North Lincolnshire		West Lindsey	
		Overall Index of Depriv-ation	Health domain	Overall Index of Depriv-ation	Health domain	Overall Index of Depriv-ation	Health domain
40-50%	↓	5%	12%	15%	14%	13%	12%
50-60%		5%	15%	11%	25%	13%	15%
60-70%		12%	9%	15%	11%	12%	13%
70-80%		7%	3%	11%	7%	8%	23%
80-90%		10%	2%	10%	0%	15%	2%
90-100%	Least deprived	3%	2%	3%	0%	6%	0%

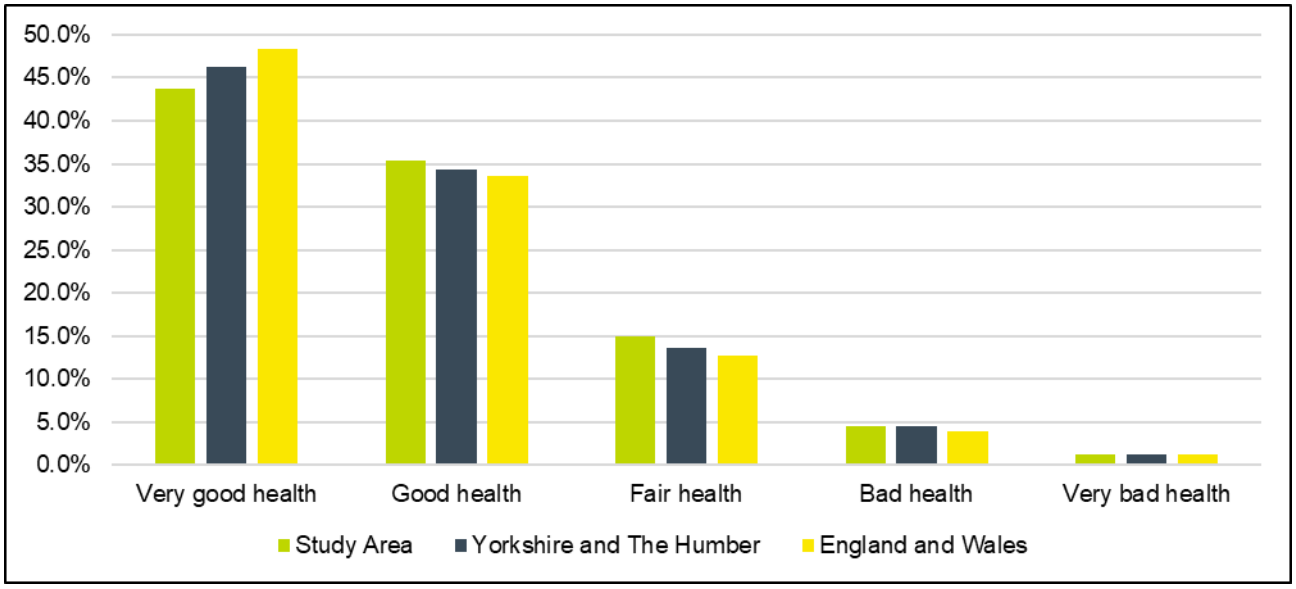
Source: Ministry of Housing, Communities and Local Government, (2019); Indices of deprivation (Ref 24-28).

Health Profile

24.6.10 This section provides a human health profile of the study area, focussing on key determinants of health relevant to the assessment criteria provided within the HUDU/NHS England guidance (Ref 24-15). This local health baseline will be used to inform the assessment of potential health effects of the Project.

24.6.11 Based on 2021 Census data (Ref 24-27), which is the latest dataset available for self-assessment of health, 5.9% of residents of the study area consider their health to be ‘bad’ or ‘very bad’. This is broadly in line with the equivalent proportion of residents in the Yorkshire and The Humber region (5.8%) and across England and Wales (5.2%). Self-reported health in each of the considered geographies is shown in **Plate 24-4**.

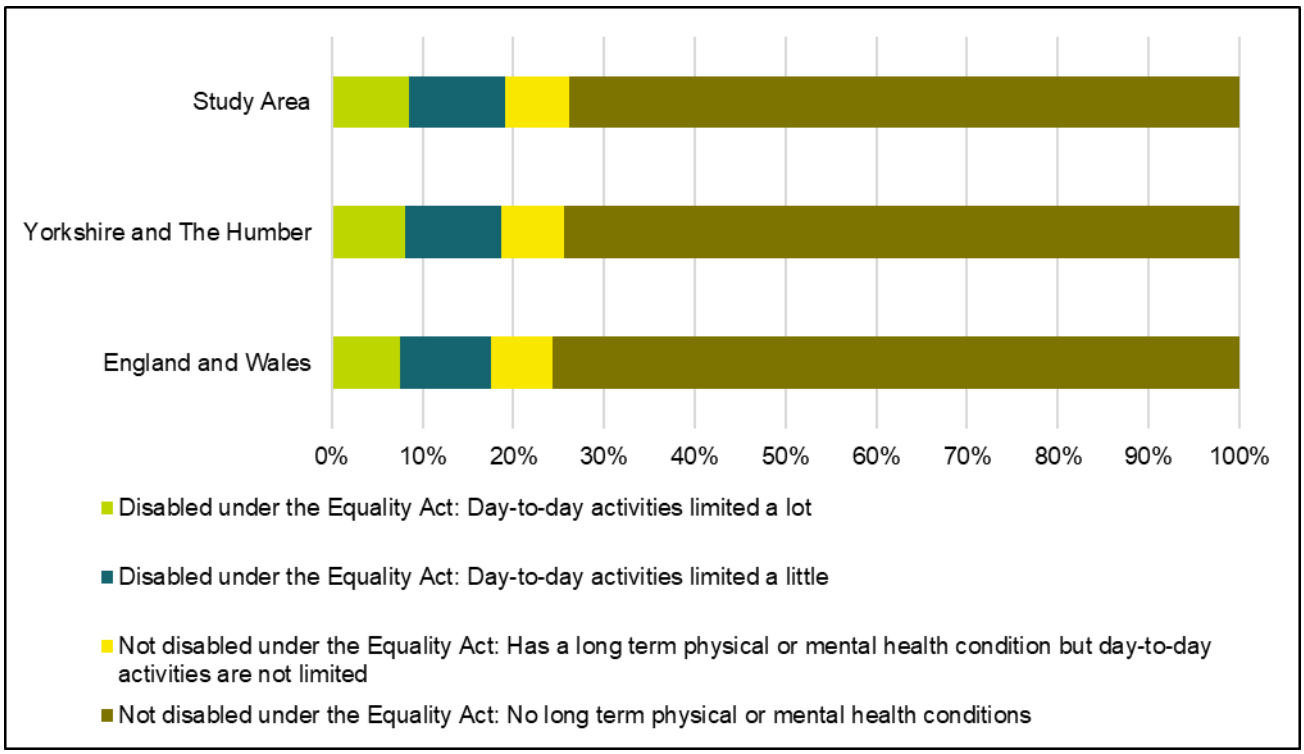
Plate 24-4: Self-assessment of Health



Source: Ref 24-27

24.6.12 Additionally, **Plate 24-5** illustrates a self-assessment of long-term health or disability, whereby a health problem limits a person's daily activities and has lasted at least 12 months. The proportion of residents within the study area who experience limitations to their daily activities arising from a long-term health condition or disability ('a little' or 'a lot') is 19.2%, which is marginally above the regional (18.6%) and national (17.5%) equivalent rates.

Plate 24-5: Self-assessment of Long-term Health or Disability



Source: (Ref 24-27)

24.6.13 Wider determinants of overall health can also provide insight into the health profile of an area. A number of indicators of health within the relevant local authority areas, derived from OHID (Office for Health Improvement and Disparities) data (Ref 24-29 and Ref 24-30) is provided in **Table 24-11**. A comparison with regional and national data is also provided, where applicable. In summary:

a. Male and female life expectancies in North Lincolnshire and North East Lincolnshire are broadly in line with the regional average, albeit slightly lower than the national average. Male and female life expectancies in West Lindsey are higher than the regional and national average (Ref 24-29).

b. The under 75 mortality rates from all causes is lower in North Lincolnshire and West Lindsey than the regional average, although in North East Lincolnshire the rate is higher; this is also true when considering the under 75 mortality rates from cardiovascular diseases and cancer (Ref 24-29).

c. In terms of risk determinants, there is a higher prevalence of smoking in the relevant local authority areas than is recorded regionally and nationally. A similar proportion of adults are physically active in North East Lincolnshire and West Lindsey when compared to the region and England as a whole, yet in North Lincolnshire the proportion is notably lower. A higher proportion of adults are classified as overweight or obese within the considered local authority areas than across Yorkshire and The Humber, and England as a whole (Ref 24-29).

d. Health outcomes in the relevant local authorities exhibit worse incidence and prevalence than is typical of England. For example, there is a greater prevalence of coronary heart disease ("CHD"), a greater prevalence of stroke, a greater prevalence of heart failure, and a greater prevalence of chronic obstructive pulmonary disease (Ref 24-30). However, the incidence of tuberculosis is notably lower in the relevant local authorities compared to the national rate.

Table 24-11: Wider determinants of health

Determinant of health	Year	Age Range	Unit	North Lincolnshire	North East Lincolnshire	West Lindsey	Yorkshire and The Humber	England
Life expectancy at birth - male	2018 - 2020	n/a	Years	78.7	78.0	79.5	78.4	79.4
Life expectancy at birth - female	2018 - 2020	n/a	Years	82.7	82.2	83.4	82.2	83.1
Under 75 mortality rates from all causes	2018 - 2020	<75 yrs	No. per 100,000	367.7	387.0	309.2	372.7	336.5
Under 75 mortality rates from all cardiovascular diseases	2017 - 2019	<75 yrs	No. per 100,000	72.2	92.0	66.3	80.2	70.4
Under 75 mortality rate from cancer	2017 - 2019	<75 yrs	No. per 100,000	136.9	152.6	125.8	137.5	129.2
Deaths from respiratory diseases	2016 – 2020	All ages	Standardised Mortality Ratio	113.4	106.4	83.5	n/a	100.0
Smoking Prevalence in adults (18+) - current smokers (APS)	2019	18+ yrs	%	17.8	16.5	15.5	12.9	12.1
Physically active adults	2020/21	19+ yrs	%	58.3	63.7	67.1	65.2	65.9

Determinant of health	Year	Age Range	Unit	North Lincolnshire	North East Lincolnshire	West Lindsey	Yorkshire and The Humber	England
Adults (aged 18+) classified as overweight or obese	2020/21	18+ yrs	%	67.6	67.6	67.3	66.5	63.5
TB incidence (three-year average)	2018 - 2020	All ages	No. per 100,000	3.5	1.7	1.1	5.9	8.0
Estimated prevalence of CHD	2015	55 – 79 yrs	No. per 100,000	8.1	8.2	7.6	n/a	7.9
Estimated prevalence of stroke	2015	55 – 79 yrs	No. per 100,000	3.9	3.9	3.7	n/a	3.7
Estimated prevalence of heart failure	2015	>16 yrs	No. per 100,000	1.6	1.6	1.9	n/a	1.4
Estimated prevalence of COPD	2015	All ages	No. per 100,000	3.5	3.9	3.4	n/a	3.0

Source: Ref 24-29,Ref 24-31 and Ref 24-32

Healthcare Facilities

24.6.14 As detailed in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the nearest hospitals (with an accident and emergency department) to the Project are St.Hugh's Hospital and Diana, Princess of Wales Hospital, located approximately 9km from the Project.

24.6.15 There are three GP surgeries within 5km of the Site, as set out in **Table 24-12**: The Roxton Practice in Immingham (1km from the Site Boundary), Killingholme Surgery in South Killingholme (approximately 4km from the Site Boundary), and Healing Partnership (around 4km from the Site Boundary). The latest General Practice data (April 2023) published by NHS Digital (Ref 24-31 and Ref 24-32). **Table 24-12** indicates that these GP surgeries have a total of 18.1 GPs (Full Time Equivalent ("FTE")) and provide care to 37,996 patients. This corresponds to 2,099 patients per GP, which exceeds the Royal College of General Practitioners target (Ref 24-33) of 1,800 patients per GP.

Table 24-12 GP surgery patient list size and workforce

General Practice surgery	Number of patients	Number of GPs (FTE)	GP:Patient Ratio
The Roxton Practice	34,065	15.9	2,142
The Killingholme Surgery	1,545	1.4	1,104
Healing Partnership	2,386	0.8	2,983
Total	**37,996**	**18.1**	**2,099**

Source: Ref 24-31 and Ref 24-32

24.6.16 As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the GP surgeries shown in **Table 24-13** are within the NHS Humber and North Yorkshire Integrated Care Board ("ICB"). Information on the ratio of patients to GPs (FTE) is shown in **Table 24-13**. It is shown that the ratio of patients to GPs (FTE) is below (i.e. better than) the Royal College of General Practitioners target of 1,800 patients per GP.

Table 24-13: ICB patient list size and workforce

Sub-ICB	Number of patients	Number of GPs (FTE)	GP:Patient Ratio
NHS Humber and North Yorkshire ICB	1,790,490	1,059	1,691

Source: Ref 24-31; Ref 24-32;

Social Infrastructure, Community and Recreational Facilities

24.6.17 There is one primary school within 1km of the Site Boundary. This is The Canon Peter Hall C of E Primary School located approximately 1km west of the Site.

24.6.18 There is one police station in proximity to the Site, located in Immingham, approximately 1.5km west of the Site Boundary. Additionally, Immingham East Fire Station is located less than 1km from the Site Boundary. In addition to the social infrastructure facilities outlined above, there are a range of community and recreational facilities within the study area. **Table 24-14** illustrates these facilities and their distances from the Site Boundary.

Table 24-14: Community and recreational facilities

Receptor	Description	Approximate distance from Site Boundary
Immingham Sea Wall	Sea wall for flood protection used by recreational sea anglers.	0m and adjacent
Community Recycling Facility	Utilities facility	<500m
Woodlands Sports Ground	Recreation facility	1.5km
Petrol Station	Community facility	1.0km
Immingham West Fire Station	Emergency Services facility	2.7km
Large supermarket	Community facility	1.5km
Homestead Park	Publicly accessible open space	1.5km
Eastfield Primary School	Primary school	1.5km
Killingholme Primary School	Primary school	5km
Goxhill Primary School	Primary school	11km
Keelby Primary Academy	Primary school	5.5km
Stallingborough C of E Primary School	Primary school	3km

Public Rights of Way

24.6.19 As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, there are two PRoWs of relevance to the Project. These are shown in **Table 24-15**.

Table 24-15: Public Rights of Way within 500m of the Site

PRoW	Type	Approximate distance from Site Boundary (m)
Public Bridleway 36	Bridleway – forms part of the recreational route known as England's Coastal Path (which was established as a National Trail in 2020)	0m
Public Footpath 32	Footpath – not currently in active use	<100m

Residential Properties

24.6.20 As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the area is mostly industrial and relatively sparsely populated. The closest residential properties are located on Queens Road, which lie within the Site. This consists of a cluster of terraced properties (including flats) and a detached dwelling, totalling ten dwellings. Further residential properties are also located approximately 460 - 500m to the west of the Site Boundary on the edge of the town of Immingham.

24.6.21 As explained in **Table 22-2** of **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]**, assessment of the consequences of the operation of the hydrogen production facility on surrounding land uses in terms of major hazard planning will be considered by NELC and the HSE in the context of an application for hazardous substances consent that has been submitted to and validated by NELC. It is considered that the residential use of ten properties on the west side of Queens Road (1-5, two flats at 6, an upper floor flat at 7-8, an upper floor flat at 18 and 31) will need to cease, as such residential uses are not compatible with the operation of the hydrogen production facility on the West Site and will be an impediment to the grant of hazardous substances consent. Negotiations are ongoing with the owners to acquire these properties and acquisition powers are included within the draft Development Consent Order ("DCO"). Two of those properties (7-8 and 18) are only in partial residential use. The ground floor at 7-8 Queens Road is vacant and the ground floor at 18 Queens Road is understood to be used as storage by the owner. It is intended that the entirety of these properties will be acquired. It is not considered that there will be any materially adverse effects on the operation of other businesses adjacent to the Site Boundary and within the vicinity.

Future Baseline

24.6.22 Based on observation of trends in population set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, it is shown that the population in North East Lincolnshire is projected to decrease by 2040, in contrast to the regional and national trend. The proportion of the population of working age in North East Lincolnshire is also projected to decrease by 2040, although this reflects the regional and national trend. Applicable future projections for other trends covered in the health baseline are not available given they are difficult to project due to a large number of influencing factors which are currently unknown.

24.6.23 The future human health and wellbeing baseline reflects, where applicable, that set out within other technical assessments, namely the:

a. Air quality assessment (**Chapter 6: Air Quality [TR030008/APP/6.2]**), which considers different air quality conditions in future, as described in paragraph 6.6.15.

b. Noise and vibration assessment (**Chapter 7: Noise and Vibration [TR030008/APP/6.2]**), which considers, as a worst case approach, the future baseline to be similar to at present.

c. Traffic and transport assessment (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**), which inherently considers in its assessment a modelled growth in traffic.

d. Climate change assessment (**Chapter 19: Climate Change [TR030008/APP/6.2]**), which considers for the purposes of the lifetime greenhouse gas emissions assessment the future baseline to reflect a 'business as usual' scenario.

e. Socio-economic assessment (**Chapter 23: Socio-economics [TR030008/APP/6.2]**), which considers an increase in population as described above.

24.7 Development Design and Impact Avoidance

Embedded Mitigation

24.7.1 EIA is an iterative process which informs the development of the project design. Where the outputs of the preliminary assessment identify likely significant effects, changes to the design can be made or mitigation measures can be built-in to the proposal to reduce these effects.

24.7.2 This type of mitigation is defined as embedded mitigation, which describes mitigation measures which have been identified and adopted as part of the evolution of the project design ("embedded" into the project design).

24.7.3 The Project has been designed, as far as possible, to avoid and minimise impacts and effects on health and wellbeing through the process of design development, and by embedding mitigation measures into the design. The design of the Project has been further developed to reflect the findings of ongoing engagement with stakeholders. As the design has developed, embedded mitigation measures have been refined as part of an iterative process.

24.7.4 Relevant design and mitigation measures have been identified in the relevant related chapters (**Chapter 6: Air Quality, Chapter 7: Noise and Vibration, Chapter 11: Traffic and Transport, Chapter 19: Climate Change**, and **Chapter 23: Socio-economics [TR030008/APP/6.2]**). No further design and mitigation measures have been identified which are solely related to health and wellbeing.

Standard Mitigation

24.7.5 There are no specific standard mitigation measures incorporated into the Project regarding human health and wellbeing. However, the assessment of human health and wellbeing is based on the relevant standard mitigation measures secured by the relevant chapters upon which the assessment is based (**Chapter 6: Air Quality, Chapter 7: Noise and Vibration, Chapter 11: Traffic and Transport, Chapter 19: Climate Change**, and **Chapter 23: Socio-economics [TR030008/APP/6.2]**). Additionally, these include standard measures set out within the Outline CEMP **[TR030008/APP/6.5]**, Construction Traffic Management Plan ("CTMP" and Construction Worker Travel Plan ("CWTP") **[TR030008/APP/6.7]** and Lighting Assessment **[TR030008/APP/6.4]**.

24.7.6 The human health and wellbeing assessment is presented in **Section 24.8** of this chapter. It is conducted on the basis that all applicable standard, embedded and additional mitigation measures, as set out in respective assessments of this ES, are implemented.

24.8 Assessment of Likely Impacts and Effects

24.8.1 This section presents the findings of the assessment of effects for each relevant health determinant assessed in each phase, with respect to the health impact pathway. For each health effect, significance of effect is assigned in line with methodology set out in **Table 24-7** above, whereby significance represents the relationship between sensitivity of receptor and magnitude of impact, also set out.

24.8.2 The following assessment considers residual effects as identified in the other technical assessments referenced in **paragraphs 24.4.9** and **24.4.10**.

Electromagnetic Fields

24.8.3 Electric and magnetic fields have the potential to impact on human health if recommended exposure limits are exceeded by human receptors. High-voltage underground cables can result in higher magnetic fields than overhead cables given the distance above them to the ground is typically smaller than the distance from the overhead cable to the ground. Overhead line cables can also nonetheless expose those in residential areas to EMFs.

24.8.4 With regard to human health impacts resulting from exposure to EMFs at the Project, there are no major sources of EMF anticipated to arise from the Project. All cabling associated with the Project will be 132kV (or lower) cables, and underground. The Applicant will ensure full compliance with relevant policies, and procedures on EMF exposure limits are in place at the design phase. This will include ensuring worker exposure to any EMF risks are managed through adherence to standard working practices during any cable installation and commissioning works as included within the Outline CEMP **[TR030008/APP/6.5]**.

24.8.5 As a result, there will be **no significant effect during all stages** of the Project arising in respect of human health and wellbeing in relation to EMF.

Construction

Access to healthcare services and other social infrastructure

24.8.6 Construction activities from the Project may restrict, or create severance temporarily to, the accessibility of hospitals, GPs and other social infrastructure for residents in the study area.

24.8.7 As identified within **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the construction workers required to build the Project may place some demand on healthcare services temporarily if they move to the area during the construction phase, or if emergency treatment is required. The construction of the Project is anticipated to require an average of 351 workers at any time during the construction period (although in practice the number will vary). The current level of patients per GP located within 5km of the Project exceeds the recommended

level. However, **Chapter 23: Socio-economics [TR030008/APP/6.2]** concludes that additional demand arising from the Project would not be likely to significantly affect the current access to healthcare scenario in terms of GP:patient ratio and the effect on local healthcare would therefore be temporarily minor adverse (not significant). Additionally, workers who reside locally already are likely to be registered at a practice currently and will therefore not be expected to place additional demand on local GP services.

24.8.8 In terms of access to healthcare services, **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** assesses the potential impact of construction traffic on the local road network. Residents in villages surrounding the Project are likely to use the same strategic roads (including the A180, A160, and A1173) as construction traffic associated with the Project and workers accessing the Site. **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** concludes the presence of this additional traffic is expected to have negligible effects on severance, which will therefore not be significant. An Outline CTMP **[TR030008/APP/6.7]** includes mitigation measures which the CTMP will be based upon, including relevant mitigation measures to address potential severance issues during the construction phase, including but not limited to: minimisation of works outside of working hours, advanced warning signage, and designated routeing to the Site. These measures are set out in full in the outline CTMP, the final CTMP will be secured by a requirement of the DCO **[TR030008/APP/2.1]**.

24.8.9 On the basis that the baseline information presented suggests that the provision of healthcare locally is currently sub-optimal in terms of GP:patient ratio, the sensitivity of the population to human health effects on access to healthcare services is assessed to be medium.

24.8.10 As there is no severance arising from construction traffic, the Project will not affect local residents' ability to access healthcare facilities. The impact of an influx of workers to the local area on healthcare facilities will worsen the GP: Patient ratio slightly from the baseline, the additional workers requiring healthcare would be limited to those non-home based and those potentially requiring services would vary greatly across the construction period given that labour requirements will rise and fall. Overall, the magnitude of impact on access to healthcare services is assessed to be low.

24.8.11 Taking into account the sensitivity and magnitude, the effect on human health arising from impacts on access to healthcare services during the construction period is assessed to be **minor adverse (not significant).**

24.8.12 Details of community facilities and other social infrastructure within the study area are set out in **Table 24-14**: In terms of capacity of services, as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2],** it is anticipated that construction workers will either already live within the local area, or will live temporarily within the area in temporary accommodation such as hotels (likely within Grimsby) during the construction phase. It is considered unlikely that a high proportion of workers will move to the local area with their families for the duration of the estimated 11 year construction period, and therefore there is unlikely to be an impact on the capacity of local social infrastructure.

24.8.13 In terms of access to social infrastructure, as outlined above, **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** sets out an assessment of the likely impact of additional traffic on severance and concludes effects during the construction phase will be negligible (not significant). As above, the Outline CTMP includes measures, that will be included in the final CTMP, to manage construction traffic resulting from the Project in order to limit any potential disruptions and implications on the wider transport network, as well as for existing road users.

24.8.14 Public Bridleway 36, will be temporarily diverted for the duration of the first phase of construction, after which it would be re-instated on its current alignment and the temporary diversion would be closed. Details are set out in Section 23.8 of **Chapter 23: Socio-economics [TR030008/APP/6.2].** Whilst the temporary diversion is in place, users of Public Bridleway 36 who may be using that route to access healthcare services and social infrastructure will incur additional journey length in terms of distance and time. However, the additional journey length is short in nature, within the same surroundings and overall access will be maintained between the locations at either end of the diversion route.

24.8.15 As a result of the temporary diversion of Public Bridleway 36, as assessed in subsequent sections of the human health and wellbeing assessment, recreational sea anglers, including any clubs will no longer have access along the sea front shown in the area indicated on **Figure 23.6 [TR030008/APP/6.3]** (refer to **Chapter 23: Socio-economics [TR030008/APP/6.2]**). Once the PRoW has re-opened on its original alignment, it is anticipated that access for the sea anglers will be possible along the sea front up to the point where Public Bridleway 36 diverts into the Long Strip.

24.8.16 On the basis that the baseline information presented indicates that there is a range of community facilities and other social infrastructure and the sharing of resources between the population and the construction workers is anticipated to be limited, the sensitivity of the population with regard to access to social infrastructure is assessed to be low.

24.8.17 As there is no severance arising from construction traffic, the Project will not affect local residents' ability to access services. Any change in existing users' provision of social infrastructure arising from use by workers would be expected to be very slight, with any impact on health attributed to the Project being imperceptible, if there is any change at all. Overall the magnitude of the human health impact on access to social infrastructure is assessed to be low.

24.8.18 Taking into account the sensitivity and magnitude, the effect on human health arising from impacts on access to other social infrastructure during the construction period is assessed to be **negligible (not significant).**

Emissions of dust, noise, and vibration

24.8.19 The construction activities of the Project have the potential to reduce air quality, which could potentially lead to adverse health effects on residents and/or disrupt local amenities. An assessment of the risk of dust, site plant and Non-Road Mobile Machinery ("NRMM") emissions, vessel emissions and traffic emissions during the construction phase is provided in **Chapter 6: Air Quality [TR030008/APP/6.2]**. The assessment considers residual air quality effects on all

sensitive receptors are unlikely to be significant given the implementation of mitigation measures including those recommended by Institute of Air Quality Management ("IAQM"), as detailed in **Chapter 6: Air Quality [TR030008/APP/6.2]**.

24.8.20 Baseline data with respect to air quality indicates low concentrations of NO_2 and background pollutants in the local study area. Rates of deaths from respiratory diseases are however higher in the local area, relative to national average rates. Moreover, incidence of COPD is higher in the local area compared with the national incidence rate. Achieving good air quality is a local priority. The sensitivity of the local population with respect to air quality, owing to the relatively poor health status and limited capacity to adapt to variation in air quality, is assessed to be medium.

24.8.21 The air quality impacts arising from the construction phase of the Project would be temporary over the 132 month construction period. Based on the conclusions of the air quality assessment set out in **Chapter 6: Air Quality [TR030008/APP/6.2]**, local impacts are likely to be minimal, following mitigation best practice measures set out in the Outline CEMP **[TR030008/APP/6.5]**. Overall, the magnitude of change anticipated with respect to air quality impacts on human health during the construction phase is therefore assessed to be low.

24.8.22 Taking into account the sensitivity and magnitude, overall the likely effect on human health arising from impacts on air quality during the construction phase of the Project is assessed to be **minor adverse (not significant)**.

24.8.23 The construction activities of the Project have the potential to lead to increases in noise and vibration, which could potentially lead to adverse health effects on residents in terms of annoyance and/or disruption of local amenities. An assessment of the impact of the construction phase of the Project on noise and vibration is provided in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. It is assessed that following impact avoidance measures and additional noise specific measures, the noise effects at residential Noise Sensitive Receptors ("NSRs") on Queens Road (in the worst case scenario that these properties remain occupied during the construction phase) may be minor adverse and not significant. Likewise, the assessment of construction vibration on residential NSRs with respect to annoyance is assessed to be minor adverse and not significant.

24.8.24 Baseline data with respect to noise indicates low levels of existing noise across the local study area. Given the industrial local setting and existing activities associated with the Port of Immingham and inward/outward road and marine traffic, the existing population is likely to be exposed to low levels of background noise consistently. The sensitivity of the population with respect to changes in noise and vibration, owing to high adaptation capacity is therefore assessed to be low.

24.8.25 Overall the magnitude of change anticipated with respect to noise and vibration impacts on human health during the construction phase is therefore assessed to be low.

24.8.26 Taking into account the sensitivity and magnitude, overall the effect on human health arising from impacts on noise and vibration during the construction phase of the Project is assessed to be **negligible (not significant)**.

Air/noise emissions linked with traffic

24.8.27 An assessment of construction phase road traffic emissions has been undertaken in **Chapter 6: Air Quality [TR030008/APP/6.2]**. Construction activities associated with the Project, namely material and worker transport, will introduce vehicles to the local road network. An increase in vehicle traffic has the potential to reduce air quality, which could potentially have an adverse impact on human health. Although these movements on the local road network have the potential to contribute to a significant effect, it is assessed that the annual daily average vehicle movements are not numerous enough to contribute to a significant effect. Furthermore, a review of background pollutant conditions for NO_2, PM_{10} and $PM_{2.5}$ shows that the existing air quality conditions are of a good standard in this location where there a limited number of sensitive residential receptors. The air quality effect of construction traffic is found to be not significant.

24.8.28 The sensitivity of the local population with respect to air quality is medium as described in **paragraph 24.8.20**.

24.8.29 Given that it is assessed that the air quality impact of the emission of airborne pollutants associated with construction traffic is not significant, and that the exposure is low, temporary, and affects a small minority of the population, the magnitude of this impact is therefore low.

24.8.30 Overall the effect on human health arising from air quality effects associated with traffic during the construction phase is assessed to be **minor adverse (not significant)**.

24.8.31 Construction activities associated with the Project, namely material and worker transport, will introduce vehicles to the local road network. An increase in vehicle traffic has the potential to increase noise locally, which could potentially have an adverse impact on human health. An assessment of noise emissions linked with traffic during the construction phase is provided in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. It is assessed that at the location which is expected to experience the greatest percentage increase in traffic flows (Queens Road), the predicted change in traffic noise levels would be <1.5 dB(A), which would be considered to be of low magnitude in the short term.

24.8.32 The sensitivity of the local population with respect to changes in noise and vibration is as described in **paragraph 24.8.24** owing to high adaptation capacity is therefore assessed to be low.

24.8.33 It is assessed that there will be negligible noise impact due to construction traffic, even at the location with the highest proportional increase in traffic. There would also be minimal exposure to this noise for human receptors, and this would only affect a small minority of the population.

24.8.34 Therefore, with respect to human health, the magnitude of this impact is assessed to be low.

24.8.35 Overall, the effect on human health arising from noise effects associated with traffic during the construction phase is assessed to be **negligible (not significant).**

Accessibility to open space, and active travel

24.8.36 Construction activities associated with the Project may intersect, or otherwise impact upon, the accessibility of PRoW, open space and active travel networks in the study area.

24.8.37 As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, there are two PRoW within 500m of the Site Boundary. Public Footpath 32, in addition to not being in active use, will be unaffected by the construction of the Project as the only relevant work in this area is the underground pipeline corridor which it is assumed will be constructed using Horizontal Directional Drilling, therefore there will be no interruption of access or the ability to use this route for active travel, such as walking. Public Bridleway 36 will be temporarily diverted for the first phase of the construction period, the details of which are set out in the **Section 23.8** of the chapter. Due to the temporary diversion in place, users of Public Bridleway 36 will incur additional journey length in terms of distance and time. However, the additional journey length (m) is short in nature, as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2],** within the same surroundings and overall access will be maintained between the locations at either end of the diversion route. Additionally, informal access to the southern part of the Long Strip woodland will be prevented during construction to minimise pedestrian traffic near the construction works, although informal access is only currently used on an infrequent basis.

24.8.38 As set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, it is concluded that during the construction phase (peak construction year) there will be no significant effects on pedestrian amenity, fear and intimidation, or highway safety.

24.8.39 Given the medium term duration of the impacts (132 month construction period), the minimal change in quality of life that could arise for cyclists and pedestrians affected by increased traffic flows, and the rapid reversal in the effect once the construction phase is completed, the overall magnitude of change anticipated on accessibility and active travel and the prioritisation of walking and cycling, including on Public Bridleway 36, during the construction phase is assessed to be low.

24.8.40 Supporting physical exercise is a key local health priority, as set out in local health strategies. As described in the baseline section above, there is limited PRoW provision in the local area, although the A1173 and Kings Road form part of the ‘Immingham to Grimsby Cycle Superhighway’ cycling route. Local residents are in relatively poor health overall, for example the percentage of physically active adults is lower than is typical for the region and nationally; likewise the proportion of adults who are overweight or obese is higher than the regional and national averages. The sensitivity of the local population with respect to prioritisation of walking and cycling is therefore assessed to be medium.

24.8.41 Based on above, the potential human health and wellbeing impact arising from potential impact on walking routes during the construction phase is assessed to be **minor adverse (not significant)**.

Climate change

24.8.42 Climate change poses a threat to the health, safety and security of the global population, both through direct hazards and indirectly due to damage to the living environment. **Chapter 19: Climate Change [TR030008/APP/6.2]** sets out the anticipated GHG emissions impacts associated with the construction phase of the Project, of which the majority of the adverse impact concluded will be associated with embodied carbon from construction materials.

24.8.43 Total emissions from the 11-year construction period are calculated to be 818,694 tCO_2e, with average annual emissions expected to be 67,422 tCO_2e for terrestrial construction and 25,609 tCO_2e for marine construction. This represents less than 0.02% of each of the applicable UK carbon budgets.

24.8.44 Baseline data with respect to GHG emissions indicates negligible levels of existing emissions generated across the existing Site Boundary (the baseline assumes zero emissions). As set out in **Chapter 19: Climate Change [TR030008/APP/6.2]**, due to the nature of GHG emissions, and their cumulative impact on the global climate, IEMA considers that all GHG emissions contribute to climate change. While temporary adverse impacts on GHG emissions levels are anticipated during the construction phase, this is to be considered in the context of the opportunity the Project represents to positively respond to the challenges of climate change, and reduce the UK's carbon footprint. Overall, the magnitude of change anticipated with respect to GHG emissions on human health during the construction phase is therefore assessed to be very low.

24.8.45 The local population has moderate levels of deprivation and generally poorer health status in comparison to wider geographies. Daily activities, however, are not limited, and there is only a slightly higher incidence of disability locally. Therefore, the sensitivity to the negative effects of climate change on human health amongst the local population is medium.

24.8.46 Overall the effect on human health arising from impacts on GHG emissions during the construction phase of the Project is assessed to be **negligible (not significant)**.

Access to employment and training

24.8.47 Construction activities associated with the Project will provide access to employment in this phase, which will provide a beneficial health impact to these workers. There is evidence that employment matters to health, not only from an economic perspective, but also in terms of quality of life (Ref 24-22 and Ref 24-23). Good quality work protects against social exclusion through the provision of income, social interaction, identity, and purpose.

24.8.48 As set out above, the construction period for the Project is expected to be approximately 132 months, with each of the six phases lasting approximately 24 months, with the exception of the first phase which is expected to last 36 months.

24.8.49 An assessment of the number of jobs created during the construction phase is provided in **Chapter 23: Socio-economics [TR030008/APP/6.2]**. It is estimated that during this phase the Project will support, on average, approximately 1,012 full-time jobs. Once existing employment on-site (ten FTE jobs which could be accommodated at 7-8 and 18 Queens Road), phasing, leakage, displacement, and multiplier effects have been accounted for, net job creation is 627jobs. Of these, 438 jobs will be expected to be taken up by residents within North East Lincolnshire. In practice, this number will vary across the construction period.

24.8.50 Broadly, at least some of the construction jobs created will be in the clean energy sector, specifically through the construction of hydrogen production facility. As such, they will contribute to the development of skills needed for the UK's transition to net zero. It is likely that the appointed contractors will employ trainees and apprentices as part of the construction workforce. The jobs arising from the construction phase of the Project would be temporary over the 132 month construction period. The anticipated 438 additional jobs within North East Lincolnshire would represent local jobs growth and a substantial increase in the context of the 2,500 construction employees in North East Lincolnshire (as set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**). Overall, the magnitude of impact anticipated with respect to employment and income during the construction phase is therefore assessed to be high.

24.8.51 Baseline data with respect to employment indicates lower rates of economic activity, higher rates of unemployment and lower Gross Value Added ("GVA") per worker within North East Lincolnshire compared to national averages. The sensitivity of the local population with respect to employment and income is therefore assessed to be medium.

24.8.52 Overall the effect on human health arising from impacts on employment and income during the construction phase of the Project is assessed to be temporary **major beneficial (significant)** at the North East Lincolnshire scale.

Social cohesion and lifetime neighbourhoods

24.8.53 Roads bordering the Project may be used by construction traffic which could increase traffic and community severance between neighbourhoods. This could reduce access to community facilities and in turn reduce social cohesion.

24.8.54 Baseline data with respect to human health indicates that there are poorer than average health outcomes regarding some health factors amongst the local population, but others are in line with national averages. There are lower than average physical activity rates across the study area. Therefore, the population is assessed to have medium sensitivity.

24.8.55 As set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, with embedded mitigation measures in place, there are no road links for which a significant effect is found. Through the adoption of the CTMP and CWTP,

measures will be put in place to limit any such impact as far as reasonably possible.

24.8.56 Increased traffic flows and severance effects may inhibit local residents' ability to access neighbouring communities and social contacts, however, the extent of this will be very limited, given that no significant effect arising in respect of traffic and transport is concluded. The duration of impact is medium term, but the number of residents and neighbourhoods affected is low. Therefore, overall the magnitude of impact is assessed to be low.

24.8.57 Overall, the human health impact on social cohesion and lifetime neighbourhoods during the construction phase is assessed to be **minor adverse (not significant).**

Operation

Access to healthcare and other social infrastructure

24.8.58 As a result of the operation of the Project and the associated employment, there is the potential for local healthcare services or other social infrastructure to be impacted due to restrictions to, or severance to, the accessibility of hospitals, GPs and other social infrastructure.

24.8.59 As identified in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the operational employment associated with the Project, in a worst-case scenario that all workers register at a local GP practice, would be likely to have a minor adverse effect on local provision, which would not be significant.

24.8.60 As set out above, as the provision of healthcare locally is currently sub-optimal in terms of GP:Patient ratio, the sensitivity of the population to human health effects on access to healthcare services is assessed to be medium.

24.8.61 On the basis that the service quality implications of additional workers registering or utilising local GP surgeries would be only very slight, the magnitude of the human health impact on access to healthcare is assessed to be very low.

24.8.62 Overall the health impact on access to healthcare services during the operational phase is assessed to be **negligible (not significant).**

24.8.63 During the operational phase, there are expected to be 134 full time staff working within the Site Boundary per day. These workers are expected to have a negligible impact on demand for social infrastructure (excluding healthcare) locally.

24.8.64 **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** concludes that there will be negligible (not significant) effects in terms of severance during the operation phase.

24.8.65 As set out above, as there are a range of community facilities and other social infrastructure, and that the sharing of resources between the population and the operation workers is anticipated to be limited, the sensitivity of the population with regard to access to social infrastructure is assessed to be low.

24.8.66 Given that it is assessed that severance effects are expected to be negligible and any service quality implication regarding capacity of social infrastructure would be

expected to be very slight, if it all, the magnitude of the human health impact on access to social infrastructure is assessed to be very low.

24.8.67 Therefore, the potential health impact on access to social infrastructure during operation is assessed to be **negligible (not significant)**.

Air/noise pollution linked with traffic

24.8.68 Operational activities associated with the Project, namely goods and worker transport, will introduce vehicles to the local road network. An increase in vehicle traffic has the potential to reduce air quality, which could potentially have an adverse impact on human health.

24.8.69 An assessment of the air quality effects associated with operational road traffic is provided in **Chapter 6: Air Quality [TR030008/APP/6.2]**. It is concluded that the anticipated operational traffic would result in a negligible (not significant) air quality effect.

24.8.70 As set out above, the background concentrations of pollutants and the baseline air quality in the local area is good. However, the health of the local population typically is poor, particularly with regard to respiratory diseases, and therefore the sensitivity of the local population to air quality effects is considered to be medium.

24.8.71 Given the climate change and air quality assessments do not find significant effects with regard to operational road traffic emissions, and with respect to human health that the exposure of the local population will be very low and affect a small minority of the population, the magnitude of the impact is considered to be low.

24.8.72 Overall, the human health effect resulting from air quality effects associated with operational road traffic is assessed to be **minor adverse (not significant)**.

24.8.73 An increase in vehicle traffic also has the potential to increase noise locally, which could potentially have an adverse impact on human health. An assessment of the noise effects associated with the road traffic during the operational phase of the Project is provided in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. This sets out that based on the implementation of impact avoidance measures, and following implementation of additional noise specific mitigation measures, only minor adverse effects are assessed to be likely, and therefore the Lowest Observable Adverse Effect Level (“LOAEL”) would not be exceeded.

24.8.74 On-site plant noise and operations also have the potential to increase noise locally which could potentially have an adverse impact on human health. An assessment of the noise effects associated with the this during the operational phase of the Project is provided in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**. This sets out that based on the implementation of impact avoidance measures, and following implementation of additional noise specific mitigation measures, only minor adverse effects are assessed to be likely.

24.8.75 Based on these conclusions, the magnitude of impact anticipated with respect to noise and vibration impacts on human health during the operation phase of the Project overall is assessed to be low.

24.8.76 As above, the sensitivity of the local population with respect to noise and vibration is assessed to be low.

24.8.77 Therefore, overall the effect on human health arising from noise and vibration impacts from road traffic during the operation of the Project is assessed to be **negligible (not significant).**

Access to employment and training

24.8.78 Operation activities at the Project will provide access to employment opportunities in this phase, which will provide a beneficial health impact to these workers.

24.8.79 An estimated 134 jobs will be directly generated by the Project when operational, which will potentially provide local employment opportunities in the form of permanent jobs. When additionality effects are accounted for, the total net employment generated during operation is assessed to be 189 FTE jobs.

24.8.80 As above, the implementation of local supply chain initiatives would maximise the potential for local benefits arising from the Project. For example, making sure that local businesses have the opportunity to tender for appropriate contracts. Whilst some of the services are specialised, a wide range of support services businesses already exist in the area.

24.8.81 The 134 net direct and indirect employment within North East Lincolnshire would represent local jobs growth in the context of the size of the workforce. Overall the magnitude of change anticipated with respect to employment and income during the operation of the Project is therefore assessed to be medium.

24.8.82 As above, the sensitivity of the local population with respect to employment and income is assessed to be medium.

24.8.83 Overall the potential human health effect on access to employment and training during the operation phase of the Project is assessed to be **moderate beneficial (significant).**

Social cohesion

24.8.84 In response to the EIA Scoping Report issued in August 2022, The Inspectorate raised the potential mental health impact among local communities during the operational phase of the Project, arising from potential public safety concerns relating to the transportation of hydrogen via road within the local area.

24.8.85 As explained in **Chapter 2: The Project [TR030008/APP/6.2]**, liquid hydrogen will be produced on site. Liquid ammonia will be shipped to the jetty and then converted within the new production facilities into gaseous hydrogen which will then be turned into liquid through a hydrogen liquefier so it is easier to safely store and transport.

24.8.86 With respect to potential public safety risks, **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** sets out an assessment of safety risk and states that all risks will be mitigated to be ALARP, all operations will be subject to authorisation by the Competent Authority (HSE and Environment Agency (“EA”)), and all safety and regulatory requirements will be met in full, including obtaining

of hazardous substance consent which will itself require local planning authority consent.

24.8.87 In terms of public perception of risk, statutory consultation was undertaken to facilitate public understanding of, and listen and respond to questions about, the Project, including the process of the production of hydrogen from ammonia. The consultation also included: in-person consultation events (which included materials setting out information about the proposed project, including safety and regulatory information), a public website and online consultation room; feedback forms, available both online and at in-person events; a freephone line; a postal address; and, an email address. This ensured specific concerns were provided with a response. The channels available throughout the Statutory Consultation period gave the public many opportunities to raise questions and concerns.

24.8.88 The Project will operate in line with best practice with regard to safety, and significant public information will be made available to respond to queries on the safety aspects of the Project. However, given perception and mental health are by their nature subjective, it is possible there could be negative impacts on local mental health arising from safety concerns during all phases of the Project.

24.8.89 On the basis that consultation responses from local residents indicates that the outlook of the community with regard to the Project is predominantly not unfavourable with some concern, taking into account that consultation responses are more likely from, and therefore more reflective of the views of, residents with stronger opinions, the sensitivity of the population to social cohesion and perception of risk effects is assessed to be low.

24.8.90 Given that the severity of perception of risk relates to a very limited population and could result in only very minor changes in quality of life, rather than mortality impacts, the magnitude of impact is assessed to be very low.

24.8.91 Overall the effect on human health resulting from social cohesion effects including the perception of risk during the operation phase is assessed to be **negligible (not significant)**.

24.8.92 The removal of trees in the Long Strip has the potential to impact on human health and wellbeing in terms of disruption to enjoyment of nature, or visual amenity effects. Consultation responses were received from a local employer that there is the potential for mental health impacts on employees relating to the removal of trees.

24.8.93 As set out in **Chapter 13: Landscape and Visual Amenity [TR030008/APP/6.2]**, there is the potential for a residual moderate adverse visual amenity impact to result on users of PRoW at representative viewpoints on the adjacent Public Bridleway 36. Workers of neighbouring businesses would however only observe the loss of some trees within the Long Strip woodland when outside and would likely only have limited views of this in such instances.

24.8.94 From a human health and wellbeing perspective, workers of nearby businesses are employed, and are not limited from undertaking daily activities. Given this is a location of work, the adaptation capacity of employees to a condition of the workplace, versus a residential receptor for example, is considered to be high or

very high. Therefore, the sensitivity of nearby workers to the loss of trees is considered to be low.

24.8.95 The impact of the loss of trees on nearby workers in terms of human health and wellbeing is an occasional event, and is only predominantly related to a minor change in morbidity/moderate change in quality of life in the context of the definition of one's health as contributed to by a range of determinants. Therefore, the magnitude of impact on the human health and wellbeing of these receptors is assessed to be low.

24.8.96 Overall, the human health and wellbeing impacts of the loss of some trees in the Long Strip woodland on nearby workers is assessed to be **negligible (not significant)**.

Climate change

24.8.97 One of the key drivers for the Project is to assist the UK in meeting its net zero targets through the handling and production of green hydrogen to help decarbonise heavy industry including the transportation sector and to help facilitate the use of carbon capture and storage. The purpose of the jetty (the NSIP) is to facilitate the import and export of liquid bulk materials which support the green energy and carbon capture sectors. The hydrogen production facility (associated development) will enable green hydrogen to be produced from imported ammonia to support the transition to net zero, by providing a zero carbon fuel including for the heavy transportation sector. The ammonia will be produced using renewable energy sources.

24.8.98 Climate change poses a threat to the health, safety and security of the global population, both through direct hazards and indirectly due to damage to the environment. As set out in **Chapter 19: Climate Change [TR030008/APP/6.2],** GHG emissions during the operational phase of the Project will be associated with utilities and transport, the majority of which will be associated with shipping emissions (although in the future, a gradual switch in the shipping fleet to the use of decarbonised fuel is expected). Embedded mitigation measures including the use of best available techniques for energy management as required in connection with the obtaining of the necessary Environmental Permit to operate the hydrogen production facility will be implemented to avoid or minimise operational emissions. Operational emissions should be considered in the context of the potential national emissions reductions the Project will facilitate including through decarbonisation of UK transport. It is assessed that the emissions resulting from the operations of the Project over its operational life would be significantly less than the avoided emissions of the Project. Moreover, the Project will displace fossil fuels and has the potential for future CO2 sequestration. As above, the sensitivity of the local population with respect to GHG emissions is assessed to be medium.

24.8.99 However, in the context of the overarching objective of the Project to contribute to the UK's drive to net zero, the magnitude of impact on human health is assessed to be very low.

24.8.100 Overall, the effect of the Project during the operation phase on human health due to climate change impacts is assessed to be **negligible (not significant).**

Decommissioning

Access to healthcare services and other social infrastructure

24.8.101 Decommissioning activities from the Project may restrict, or create severance to, the accessibility of hospitals, GPs and other social infrastructure for residents in the study area.

24.8.102 As identified in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, the employment associated with the decommissioning of the Project is expected to be less than the construction phase, given that decommissioning will only be of the hydrogen production facility and potentially associated jetty topside infrastructure. Therefore, in a worst case scenario that all of the workers associated with this phase register at GP surgeries locally, the access to healthcare impact in terms of GP:patient ratio will be no worse than that resulting from the construction phase. As previously stated, the sensitivity of the population is medium and the magnitude of impact, based on the understanding that the impact will be lower than reported during the construction phase, remains very low. Therefore, the effect on access to healthcare during the decommissioning phase is expected to be **negligible (not significant)**. This assumption is based on current levels of provision and it is likely that both provision of healthcare and registered patients will be different in future.

24.8.103 **Chapter 11: Traffic and Transport [TR030008/APP/6.2]** explains that traffic flows cannot be accurately forecasted for over 25 years in the future (noting that despite the 25 year operation period it is likely that certain elements of the Project will be operational for a longer period of time). However, the Project's impact on local residents' ability to access healthcare facilities in the decommissioning phase is expected to be the same or less as during construction, based on the expected similar number of trips and duration of these phases.

24.8.104 As previously stated, the sensitivity of the population is medium, and the magnitude of impact, based on the understanding that the impact will be lower than reported during the construction phase, remains very low. Based on above, the potential health effect on access to healthcare facilities and other social infrastructure during decommissioning is therefore assessed to be **negligible (not significant).**

Emission of dust, noise, vibration and odours

24.8.105 The decommissioning activities of the Project have the potential to reduce air quality, which could potentially lead to adverse health effects on residents and/or disrupt local amenities. An assessment of the impact of the decommissioning of the Project on air quality has been scoped out of the assessment as no significant effects are considered likely, as set out in **Chapter 6: Air Quality [TR030008/APP/6.2]**.

24.8.106 The construction activities of the Project have the potential to lead to increases in noise, which could potentially lead to adverse health effects on residents and/or disrupt local amenities. An assessment of the impact of decommissioning of the Project on noise and vibration is provided in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**.

24.8.107 The assessment concludes that the impact of the decommissioning of the hydrogen production facility is likely to be similar to the construction period and therefore the assessment considers residual noise effects to be not significant.

24.8.108 As previously stated, the sensitivity of the population with respect to noise and vibration is low. Based on the understanding that the impact will be similar to the construction period, the magnitude is assessed to be low. Therefore, the potential health impact resulting from the decommissioning impacts such as noise and vibration is assessed to be **negligible (not significant).**

Air/noise pollution linked with traffic

24.8.109 Decommissioning activities associated with the Project, namely material and worker transport, will introduce vehicles to the local road network. An increase in vehicle traffic has the potential to reduce air quality, which could potentially have an adverse impact on human health and/or disrupt local amenities. An assessment of the impact of the decommissioning of the Project on air quality has been scoped out of the assessment as no significant effects are considered likely, as set out in **Chapter 6: Air Quality [TR030008/APP/6.2]**. Likewise, from a greenhouse gas perspective, **Chapter 19: Climate Change [TR030008/APP/6.2]** states that the UK will be achieving net zero by the time decommissioning activities commence and thus the relative and material impact will be much reduced, compared to the construction phase.

24.8.110 Therefore, the potential health effect in relation to air pollution linked with traffic resulting from the decommissioning activities is assessed to be **no effect**.

24.8.111 Decommissioning activities associated with the Project, namely material and worker transport, will introduce vehicles to the local road network. An increase in vehicle traffic has the potential to increase noise locally, which could potentially have an adverse impact on human health.

24.8.112 As set out in **Chapter 7: Noise and Vibration [TR030008/APP/6.2]**, the residual decommissioning effects relating to noise are assumed to be equivalent to those presented for the construction phase. As previously stated, the sensitivity of the population to effects from noise emissions linked with traffic is low. Based on the understanding that the impact will be equivalent to that assessed during the construction phase, the magnitude of impact is assessed to be low. Therefore, for the purposes of the human health and wellbeing assessment, the health effect with respect to noise pollution linked with traffic is assessed to be **negligible (not significant).**

Accessibility to open space, and active travel

24.8.113 Decommissioning activities associated with the Project may intersect, or otherwise impact upon, the accessibility of PRoW, open space and active travel networks in the study area. As set out in **Chapter 23: Socio-economics [TR030008/APP/6.2]**, it is assessed that in a worst case scenario Public Bridleway 36 will be temporarily diverted for the duration of the decommissioning of the hydrogen production facility. Thus, the effect on users of PRoW for active travel such as walking is assessed to be minor adverse, which is not significant.

24.8.114 As previously stated, the sensitivity of the population with respect to this determinant is medium, and based on the understanding that the impact will be at worst equivalent to that assessed during the construction phase, the magnitude of impact is assessed to be low. Therefore the potential human health and wellbeing effect arising from potential impact on walking routes during the decommissioning phase is assessed to be **minor adverse (not significant)**.

Access to employment and training

24.8.115 Decommissioning activities at the Project will provide access to employment opportunities in this phase, which will provide a beneficial health impact to these workers. An assessment of the number of jobs created during the decommissioning phase is provided in **Chapter 23: Socio-economics [TR030008/APP/6.2]**. The assessment concludes that employment generated will be lower in magnitude and of a shorter duration than during the construction phase. Although it is not possible to state the amount of employment generated per annum, a proportion of employment will be expected to be taken up by residents within North East Lincolnshire.

24.8.116 As previously stated, the sensitivity of the population with respect to access to employment and training is assessed to be medium. Based on the understanding that the impact will be lower than during the construction phase, the magnitude of impact is assessed to be low. Therefore, the potential human health and wellbeing effect associated with the employment opportunities during decommissioning is assessed to be **minor beneficial (not significant).**

Social cohesion

24.8.117 Roads bordering the Project may be used by decommissioning traffic which could increase traffic and community severance between neighbourhoods. This could reduce access to community facilities and in turn reduce social cohesion.

24.8.118 As set out in **Chapter 11: Traffic and Transport [TR030008/APP/6.2]**, traffic and transport effects arising from the decommissioning phase were scoped out of the relevant assessment on the basis that no significant effects were likely.

24.8.119 Therefore, the potential health and wellbeing effect associated with social cohesion during the decommissioning phase is assessed to be **no effect**.

24.9 Mitigation and Enhancement Measures

24.9.1 There are no specific additional mitigation, monitoring or enhancement measures required with respect to human health and wellbeing, given that no significant adverse effects are found within the assessment of potential impacts and effects.

24.10 Assessment of Residual Effects

24.10.1 Given that the assessment of likely impacts and effects in **Section 24.8** inherently appreciates the respective additional mitigation and enhancement measures outlined in the referenced other assessments, and that no additional mitigation measures are required with respect to human health and wellbeing as

no significant effects were found, the residual effects for the construction phase are as per those set out in **Table 24-16**.

24.10.2 Likewise, with respect to the likely human health and wellbeing impacts effects set out in **Section 24.8** during the operation phase, the residual effects are as per those reported in **Table 24-17**.

24.10.3 It is anticipated that the decommissioning phase will have a similar impact to the construction phase. However, with respect to the potential impacts and effects on human health during the decommissioning phase, it is assessed that the residual effects are as per those reported in **Table 24-18**.

24.11 Summary of Assessment

24.11.1 This chapter has provided a summary of the relevant legislation, policy and guidance for assessing health effects, and summarised the current consultation held with stakeholders on the outcomes of the Project. In addition to this, a current and future baseline has been summarised and formed the basis of the assessment of potential health effects on the local population resulting from the Project.

24.11.2 The assessment of residual health effects, following the implementation of embedded, standard, and additional mitigation measures (as reported in the other relevant assessments of the ES including implementation of the Outline CTMP and noise specific impact avoidance measures), does not identify any significant adverse effects in either the construction, operation, or decommissioning phases.

Table 24-16: Summary of health effects during construction phase

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Additional mitigation measure(s)	Residual effect Significance
Access to healthcare services and other social infrastructure	Medium	Increased demand for healthcare services	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Medium	Increased traffic and severance reducing access to healthcare facilities	Very low	Negligible (not significant)	None required	Negligible (not significant)
	Low	Disruption of access to other social infrastructure	Low	Negligible (not significant)	None required	Negligible (not significant)
Emissions of noise, dust, and vibration	Medium	Reduction in air quality leading to adverse health outcomes	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Low	Increase in noise and vibration leading to adverse health effects	Low	Negligible (not significant)	None required	Negligible (not significant)

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Additional mitigation measure(s)	Residual effect Significance
Air/noise emissions linked with traffic	Medium	Reduction in air quality relating to increased traffic on the road network leading to adverse health effects	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Low	Increases in noise relating to increased traffic on the road network leading to adverse health effects	Low	Negligible (not significant)	None required	Negligible (not significant)
Accessibility and active travel	Medium	Disruption to access of PRoW, open space and access to active travel	Low	Minor adverse (not significant	None required	Minor adverse (not significant
Climate change	Medium	Threats to local population health	Very low	Negligible (not significant)	None required	Negligible (not significant)
Access to employment and training	Medium	Beneficial health and quality of life impacts relating to access to employment opportunities, for residents, locally	High	Major beneficial (significant)	None required	Major beneficial (significant)

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Additional mitigation measure(s)	Residual effect Significance
Social cohesion and lifetime neighbourhoods	Medium	Increased traffic or severance effects which could reduce access to community facilities and lead to social cohesion	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)

Table 24-17: Summary of health effects during operation phase

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Mitigation measure(s)	Residual effect Significance
Access to healthcare and other social infrastructure	Medium	Increased demand for healthcare services	Very low	Negligible (not significant)	None required	Negligible (not significant)
	Low	Increased traffic and severance reducing access to healthcare facilities and other social infrastructure	Very low	Negligible (not significant)	None required	Negligible (not significant)
Air/noise emissions linked with traffic	Medium	Reduction in air quality leading to adverse health outcomes	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)
	Low	Increase in noise leading to adverse health effects	Low	Negligible (not significant)	None required	Negligible (not significant)
Access to employment and training	Medium	Beneficial health and quality of life impacts relating to access to employment opportunities, for residents, locally	Medium	Moderate beneficial (significant)	None required	Moderate beneficial (significant)

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Mitigation measure(s)	Residual effect Significance
Social cohesion	Low	Contribution to social cohesion and engagement with existing communities to encourage social interaction and support mental health, including perception of risk	Very low	Negligible (not significant)	None required	Negligible (not significant)
	Low	Human health and wellbeing impacts on employees of Polynt Composites owing to tree loss within Long Strip woodland	Low	Negligible (not significant)	None required	Negligible (not significant)
Climate change	Medium	Threats to global population health	Very low	Negligible (not significant)	None required	Negligible (not significant)

Table 24-18: Summary of health effects during decommissioning phase

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Mitigation measure(s)	Residual effect Significance
Access to healthcare and other social infrastructure	Medium	Increased demand for healthcare services	Very low	Negligible (not significant)	None required	Negligible (not significant)
	Medium	Increased traffic and severance reducing access to healthcare facilities and other social infrastructure	Very low	Negligible (not significant)	None required	Negligible (not significant)
Emission of noise and vibration	Low	Increase in noise and vibration leading to adverse health effects	Low	Negligible (not significant)	None required	Negligible (not significant)
Noise emissions linked with traffic	Low	Increases in noise relating to traffic on the road network leading to adverse health effects	Low	Negligible (not significant)	None required	Negligible (not significant)
Accessibility to open space, and active travel	Medium	Disruption to access of PRoW, open space and access to active travel	Low	Minor adverse (not significant)	None required	Minor adverse (not significant)

Health determinant	Sensitivity	Description of potential impact	Magnitude	Significance	Mitigation measure(s)	Residual effect Significance
Access to employment and training	Medium	Beneficial health and quality of life impacts relating to access to employment opportunities, for residents, locally	Low	Minor beneficial (not significant)	None required	Minor beneficial (not significant)
Social cohesion	n/a	Contribution to social cohesion and engagement with existing communities to encourage social interaction and support mental health, including perception of risk	n/a	No effect	None required	No effect

24.12 References

Ref 24-1 Institute of Environmental Management and Assessment (IEMA), (2022); Guide to: Determining Significance for Human Health in Environmental Impact Assessment.

Ref 24-2 HM Government, (2022); British Energy Security Strategy.

Ref 24-3 Department for Transport, (2012); National Policy Statement for Ports.

Ref 24-4 Ministry of Housing, Communities and Local Government (2021); National Planning Policy Framework.

Ref 24-5 NHS, (2019); The NHS Long Term Plan.

Ref 24-6 HM Government, (2022); Health and Care Act 2022 (c.31).

Ref 24-7 HM Government, (2022); Levelling Up the United Kingdom.

Ref 24-8 Planning Practice Guidance (2019); Guidance on promoting healthy and safe communities.

Ref 24-9 Public Health England, (2019); PHE Strategy 2020 to 2025.

Ref 24-10 HM Government, (2018); A Green Future: Our 25 Year Plan to Improve the Environment.

Ref 24-11 Institute of Health Equity, (2020); Health Equity in England: The Marmot Review 10 Years On.

Ref 24-12 Institute of Health Equity, (2020); Build Back Fairer: The COVID-19 Marmot Review. The Pandemic, Socioeconomic and Health Inequalities in England.

Ref 24-13 Institute of Health Equity, (2010); Fair Society, Healthy Lives, The Marmot Review.

Ref 24-14 Institute of Environmental Management and Assessment (IEMA), (2022); Guide to: Effective Scoping of Human Health in Environmental Impact Assessment.

Ref 24-15 NHS London Healthy Urban Development Unit (HUDU) (2019); HUDU Planning for Health: Rapid Health Impact Assessment Tool.

Ref 24-16 Wales Health Impact Assessment Support Unit (WHIASU), (2020); Health Impact Assessment (HIA): A Practical Guide.

Ref 24-17 Lincolnshire County Council (2018); Joint Health and Wellbeing Strategy and Lincolnshire.

Ref 24-18 North East Lincolnshire Council, (2018); Local Plan 2013 to 2032.

Ref 24-19 North Lincolnshire Council, (2011); North Lincolnshire Local Development Framework Core Strategy.

Ref 24-20 Central Lincolnshire Joint Strategic Planning Committee (2019); Central Lincolnshire Local Plan.

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Ref 24-25 International Commission on Non-ionizing Radiation Protection (ICNIRP), (1998); ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz).

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Ref 24-29 Office for Health Improvements and Disparities, (2022); Local Authority Health Profiles.

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Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 25: Cumulative and In-Combination Effects

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 25: Cumulative and In-Combination Effects

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Planning Inspectorate Case Reference	TR030008
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Revision 1	21 September 2023	DCO Application

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25. Cumulative and In-Combination Effects

25.1 Introduction

25.1.1 This chapter of the Environmental Statement ("ES") presents an assessment of the potential for cumulative and in-combination effects as a result of the Project.

25.1.2 The cumulative effects and in-combination assessment, hereafter referred to as the Cumulative Effects Assessment ("CEA") considers the following types of effect:

a. **In-combination (combined) effects**: these effects occur where a single receptor is affected by more than one source of effect from different aspects of the Project. An example of an in-combination effect could be where a local resident is affected by dust, noise and traffic disruption during the construction of the Project, with the overall result being a greater adverse effect on amenity than when each individual effect is considered in isolation.

b. **Cumulative effects**: these effects occur as a result of a number of developments, which individually might not be significant, but when considered together with the Project could create a significant cumulative effect on a shared receptor.

25.1.3 The assessment presented in this chapter draws on the assessment of impacts undertaken within **Chapters 6** - **24** of the ES **[TR030008/APP/6.2]**. This chapter also provides details of other proposed developments within the vicinity of the Project that may be of relevance to the CEA, using information that is available within the public domain. This includes information relating to Nationally Significant Infrastructure Projects ("NSIPs"), North East Lincolnshire Council ("NELC") Local Plan allocations, Marine License Applications, proposed schemes that have planning applications registered with the local planning authorities and/or already consented developments that have not yet been constructed or are operational.

25.1.4 The CEA does not consider developments that are already constructed and operating, as such developments are accounted for in the baseline conditions established for the assessments as reported within **Chapters 6** - **24** of this ES **[TR030008/APP/6.2]**.

9.1.1 This chapter is supported by the following figures **[TR030008/APP/6.3]**:

a. **Figure 25.1: Cumulative Assessment Long List** which illustrates the Project location in relation to other proposed developments included on the long list of schemes considered for the CEA; and

b. **Figure 25.2: Cumulative Assessment Short List** illustrates the Project location in relation to other proposed developments included on the short list of schemes considered for the CEA.

25.1.5 This chapter should also be read in conjunction with the following accompanying appendices **[TR030008/APP/6.4]**:

a. **Appendix 25.A: Cumulative Effects Assessment Long List;**

b. **Appendix 25.B: Cumulative Effects Assessment Shortlist; and**

c. **Appendix 25.C: Assessment of Cumulative Effects**

25.2 Consultation

25.2.1 A summary of consultation and responses relating to the CEA is provided in **Table 25-1**. This presents comments received from the Planning Inspectorate's Scoping Opinion (**Appendix 1.A [TR030008/APP/6.4**]) as well as the two rounds of Statutory Consultation undertaken for the Project. It also outlines how these responses have been considered in the CEA. Cumulative development ID references have been included within the consultation responses based on how they have been referenced within the CEA (these ID references are listed in **Table 25-9**).

25.2.2 The list of 'other developments' was also informed by comments received during consultation. Where further developments were identified through the consultation process, these were included within the assessment.

Table 25-1 Summary of Consultation

Reference/Date	Consultee	Summary	How addressed in the CEA
Scoping Report August 2022	Planning Inspectorate	The Scoping Report (**Appendix 1.A** of ES **[TR030008/APP/6.4]**) states that the significance of intra-project effects would be determined using professional judgement, and no further details are provided on the methodology. The ES should explain how potential interactions are identified and provide justification for the conclusions reached.	**Section 25.3** explains the methodology and approach to the in-combination effects assessment, detailing how potential interactions have been identified and considered.
		The Scoping Report does not suggest any other developments for inclusion on the longlist. The Applicant is advised to agree the list of developments with NELC, where possible. The ES should include a summary table, with relevant developments' current stage, location and timing of the proposed works to help to identify potential overlaps between activities that could lead to cumulative impacts.	The Applicant engaged with NELC on the long list of cumulative schemes for potential inclusion and consideration in the CEA. Following identification and review of the long list of cumulative schemes, a response was received from NELC on 27 June 2023 recommending the inclusion of the Velocys Waste to Fuel Plant Scheme (ID 116). This scheme has been subsequently included on the shortlist of cumulative schemes, and has been assessed within this CEA. The long list of cumulative schemes is presented in **Appendix 25.A** of the ES **[TR030008/APP/6.4]** and consists of a summary table detailing information on the location and status of cumulative schemes, where this information is available.
		The ES should include a figure depicting the locations and extent of cumulative developments in relation to the Proposed Development.	**Figure 25.1 [TR030008/APP/6.3]** supports this chapter and shows the location of the shortlisted developments for the CEA in relation to the Project. The shortlist of developments is

Reference/Date	Consultee	Summary	How addressed in the CEA
			also presented in **Appendix 25.B [TR030008/APP/6.4]**.
	North East Lincolnshire Council	In accordance with the Planning Inspectorate's Scoping Opinion, it was advised the Applicant should agree the list of developments to be included on the long list with the NELC.	The Applicant engaged with NELC on various occasions throughout the development of the long list of cumulative schemes for the Project. The long list of cumulative schemes was agreed with NELC on 27 June 2023 and the recommendation for the inclusion of an additional scheme was received from NELC which was subsequently incorporated into the assessment.
Statutory Consultation January 2023	National Grid	I confirm that National Grid Electricity Transmission PLC (NGET) has no existing apparatus within or in close proximity to the proposed site boundary. The following projects have been proposed and fall within close proximity to the proposed site boundary: · E2DC; to construct a High Voltage Direct Current subsea link from Peterhead to a location in the South Humber area; · E4D3; to construct a High Voltage Direct Current subsea link from Peterhead in the north east of Scotland to Drax in the Yorkshire area of England; · E4L5; to construct a High Voltage Direct Current subsea ink from Peterhead to a location in the South Humber area	The relationships between the National Grid identified schemes and the Project have been reviewed as part of the early stages of the CEA, these projects have been discounted during Stage 1 for the following reasons: the National Grid interactive map shows E2DC ending at Hawthorn Pit in Seaham, County Durham and not linking to the South Humber area. E2DC has therefore not been considered within the CEA as this is outside the largest Zone of Influence considered within the CEA. National Grid projects E4D3 and E4L5 do not fall within the 5km search area for major developments.
	Lincolnshire Wildlife Trust	LWT recognizes that marine works (capital dredging and piles) have been scoped in and we	The cumulative impact of the Project and maintenance dredge disposal within Grimsby

Reference/Date	Consultee	Summary	How addressed in the CEA
		will be monitoring further assessments of pile-driving impacts, capital dredging impacts and dredge disposal. We have provided details above that will facilitate assessments of dredging and construction impacts. However, we do not agree with the scoping out of maintenance dredging in the operational phase. While the Applicant has claimed that 'the predicted impacts on benthic habitats and species as a result of maintenance dredging are considered to be equivalent or lower than capital dredge and comparable to the existing maintenance dredge regime', it is currently unclear how this proposed maintenance would contribute to cumulative impacts of ongoing works within the Humber Estuary. Therefore, we recommend that maintenance dredging is scoped into further assessment, and that both capital dredging and maintenance dredging are included in future cumulative impact assessments.	and Immingham and the Sunk Dredged Channel (ID 115) has been assessed within the Stage 4 CEA, presented in **Appendix 25.C [TR030008/APP/6.4]**. Further information on the impact of maintenance dredging on habitats during the operational phase has been provided within **Section 9.8** of **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**.
	Marine Management Organisation	The common approach to cumulative assessment contains inherent contradictions, such that is can be stated (25.1.2b) that cumulative effects occur "as a result of a number of developments, which…when considered together with the Project could create a significant cumulative effect on a shared receptor"; but then also stated (25.1.5) that "The CEA does not consider developments that are already constructed and operating, as such existing operational facilities are accounted for in the baseline" (so negating a major implication of 'cumulative'). Table 25.4 item 26 also seems to	It is not appropriate to consider developments that are already constructed and operating within the CEA. These developments become part of the existing baseline and have therefore been considered inherently within each respective technical chapter of the ES as relevant (**Chapter 6 – 24 [TR030008/APP/6.2]**). This approach is explained in **Paragraph 25.1.4**. The Planning Inspectorate's Advice Note 17 (Ref 25-4) has been used to inform the CEA for the Project, and Table 2 of this advice note clarifies the developments that should be considered within the CEA and the respective

Reference/Date	Consultee	Summary	How addressed in the CEA
		indicate that cumulative assessment will only consider temporal overlap of construction phase impacts (rather than non-contiguous and lifetime impacts). Overlap of operational phases is recognised but in Table 25.5 item 16 it is then stated that there is "no certainty at present that cumulative effects can be scoped out" on the basis that changes to physical processes are spatially limited. The MMO strongly consider the retention of this cumulative assessment in any case because spatial overlap need not be the sole criterion for cumulative impacts in the case of impacts to a pathway. It would be of value to illustrate how adjacent development impacts, even where these do not directly join up, create a patchwork of impacted areas and possibly a chain of accumulating impacts along a physical process pathway, e.g. how sources and sinks of sediment may be cumulatively disrupted. Furthermore, the MMO would expect developments already constructed and operating to be included in the assessment.	tiers that should be assigned when establishing certainty. Each type of development within this table has been considered within the CEA and updated for the ES. ID 22 (Immingham Eastern Ro-Ro Terminal ("IERRT")) has been scoped into Stages 3 and 4 of the CEA, and the construction and operation of this Project has been fully assessed in relation to its potential to cumulatively interact with the Project, using information that is readily available in the public domain. Within the Stage 4 CEA, individual environmental topics have specifically addressed the potential for the Project to cumulatively interact with the IERRT scheme (**Appendix 25.C [TR030008/APP/6.4]**). All phases of the IERRT scheme (construction and operation) have been considered within the updated CEA due to the proximity and scale of this scheme in relation to the Project. The approach to the CEA is consistent with the guidance set out within the Planning Inspectorate's Advice Note 17 (Ref 25-4), therefore this is considered to be an appropriate and proportionate approach to assessing the potential cumulative effects of the Project.
	Marine Management Organisation	The cumulative and in-combination assessment provided does not reference fish receptors at this stage. The MMO would have expected to see at least a brief scoping assessment of cumulative impact in the context of marine ecology.	An assessment of Marine Ecology cumulative effects has been undertaken as part of the CEA and is presented in **Appendix 25.C [TR030008/APP/6.4]**.

Reference/Date	Consultee	Summary	How addressed in the CEA
			Fish receptors have been assessed within the ES. This can be found in **Section 9.8** of **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]**. As part of the in-combination effects assessment, the potential for in-combination effects to occur on fish and other marine ecology receptors has been assessed. Following a review of the technical **Chapters 6-24 [TR030008/APP/6.2],** it has been concluded that there will be no in-combination effects on fish. The in-combination effects assessment is presented in **Section 25.5** and details any in-combination effects identified on other marine ecology receptors.
	DFDS Seaways	There is inconsistency in the IGET consultation materials, particularly between the PEIR and the documents intended for general local audiences in how they consider the impact of the IERRT alongside the IGET. For example, the Statement of Community Consultation says that IERRT "is a separate project unrelated to the IGET project and the IGET team will make this clear in all materials and correspondence with stakeholders and the public." This approach underplays the significance of the cumulative effect of the two projects taking place in such close proximity and does not reflect the approach which is better set out in the PEIR which correctly identifies the IERRT as the development in the area with the greatest potential to lead to significant cumulative effects (PEIR Volume 1 Non-Technical Summary	The IERRT scheme is included in the CEA due to its proximity to the Project, as well as the potential for the construction and operational phases to overlap. The potential for the Project to cumulatively interact with this scheme has been fully considered and assessed in detail within the Stage 4 CEA, presented in **Appendix 25.C [TR030008/APP/6.4]**.

Reference/Date	Consultee	Summary	How addressed in the CEA
		at 5.21.) and notes that the two projects are in close spatial proximity with the potential for their construction programmes to overlap.	
	DFDS Seaways	Mitigation for the most vulnerable part of the Immingham Oil Terminal ("IOT") trunkway in the IERRT proposal suggested moving the most vulnerable part of the trunkway, the finger pier, to the eastern side of the main jetty. The IGET prohibits this as a mitigation option as it is in the same space. The IGET proposals consider that there are not likely to be significant cumulative effects in relation to the IERRT when considered together with the IGET for Major Accidents and Disasters and so provides no mitigation for what could be a potentially environmentally and commercially disastrous incident between a vessel and the IOT trunkway as it handles flammable, toxic and potentially polluting products which would affect all users of the port and could affect the operation of critical national infrastructure. This is a major safety concern and alternative mitigation needs to be provided in the IERRT DCO application that does not involve moving the finger pier, as the IGET proposal negates that option.	The mitigation proposed for IERRT is outside the scope of the Project and is subject to a separate application. Moving the finger pier as a consequence of IERRT is a matter for IERRT and that the Project understand IERRT does not consider the need to move the finger pier to the eastern side of the main jetty to be necessary mitigation. It follows, therefore, that as such the Project Development Consent Order ("DCO") application would not result in cumulative effects in this regard. The potential for the Project to cumulatively interact with IERRT has been extensively considered within the CEA and this assessment is presented within **Appendix 25.C [TR030008/APP/6.4]**.
	DFDS Seaways	The value of the ecological enhancements proposed for the IERRT have not been made clear and nothing has been further suggested in assessing the cumulative effect of both projects.	The IERRT ecological enhancements are set out within the woodland enhancement plan that is a DCO requirement for that scheme. The area of woodland subject to those enhancements will not be impacted by the Project.

Reference/Date	Consultee	Summary	How addressed in the CEA
	DFDS Seaways	We remain extremely concerned that the safety risks, in particular around the IOT trunkway have been scoped out of assessment are not being considered in cumulative effect. Mitigation is needed to address the cumulative effect which the IGET will have with the IERRT and robust measures need to put in place before IGET can go ahead.	For each safety hazard identified during the construction and operational phases of the project, such as vessel collision with another vessel, or vessel allision with an IGET berth, the potential causes and mitigation measures were reviewed. Further information on the mitigation measures planned as part of IGET and the evaluation of the potential frequency and consequences of each hazard can be found within **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** The Cumulative Effects Assessment set out within this chapter provides a detailed assessment of the potential for cumulative effects associated with the Project and the IERRT scheme. The results of this assessment are presented within **Appendix 25.C [TR030008/APP/6.4]**.
	Natural England	**Chapter 25: In-Combination Screening Assessment** The HRA will need to consider in-combination impacts from other relevant projects and plans. The in-combination requirement makes sure that the effects of numerous small proposals, which alone would not result in a significant effect, are assessed to determine whether their combined effect would be significant enough to require more detailed assessment. Plans or projects that should be considered in the in-combination assessment include the following:	The **Habitat Regulations Assessment [TR030008/APP/7.6]** considers the cumulative impacts of the Project with other identified developments, based on the criteria highlighted by Natural England.

Reference/Date	Consultee	Summary	How addressed in the CEA
		i. The incomplete or non-implemented parts of plans or projects that have already commenced; ii. Plans or projects given consent or given effect but not yet started; iii. Plans or projects currently subject to an application for consent or proposed to be given effect; iv. Projects that are the subject of an outstanding appeal; v. Ongoing plans or projects that are the subject of regular review; vi. Any draft plans being prepared by any public body; vii. Any proposed plans or projects published for consultation prior to application. Natural England has no specific comments to make on this Chapter but will provide further detailed advice on the in-combination assessments undertaken as part of the HRA. These will need to consider all of the impact pathways that has been discussed within this letter.	
Statutory Consultation June 2023	DFDS Seaways	**Cumulative effects** There is inconsistency in the IGET consultation materials, particularly between the PEIR and the documents intended for general local audiences in how they consider the impact of the IERRT alongside the IGET. For example, the Statement of Community Consultation says that IERRT "is a separate project unrelated to the IGET project and the IGET team will make this clear in all	The potential for the Project to cumulatively interact with IERRT (ID 22) has been extensively considered within the CEA (**Appendix 25.C [TR030008/APP/6.4]**) of this ES due to the nature of the works, the close proximity of both schemes, the potential for construction phases to overlap and that the IERRT scheme has the greatest potential for significant cumulative effects.

Reference/Date	Consultee	Summary	How addressed in the CEA
		materials and correspondence with stakeholders and the public." This approach underplays the significance of the cumulative effect of the two projects taking place in such close proximity and does not reflect the approach which is better set out in the PEIR which correctly identifies the IERRT as the development in the area with the greatest potential to lead to significant cumulative effects (PEIR Volume 1 Non-Technical Summary at 5.21.) and notes that the two projects are in close spatial proximity with the potential for their construction programmes to overlap. The PEIR addendum does nothing to address these concerns despite the progress of the IERRT towards examination.	
		Marine navigation and congestion – tug availability We have further concerns that marine navigation has not been considered cumulatively, in particular tug availability which is likely to be made more in demand by the IGET. If tugs are not so readily available to service the vessel movements on the IERRT and the IGET this will add to marine congestion and create delays in the vicinity.	Risk controls during construction and operation of the Project were identified at the HAZID workshop as part of the Navigational Risk Assessment ("NRA") and are summarised in **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]** and **Appendix 12.A [TR030008/APP/6.4].** The NRA also considers navigational safety impacts. Marine Navigation cumulative and in-combination effects (which includes an assessment of the cumulative impact of the Project together with IERRT) are addressed in **Chapter 25: Cumulative and In-Combination Effects [TR030008/APP/6.2]** and **Appendix 25.C: Cumulative Effects Assessment [TR030008/APP/6.4]**.

Reference/Date	Consultee	Summary	How addressed in the CEA
			Marine congestion is managed by Humber Vessel Traffic Service ("VTS") as part of the wider port movements planning/live traffic plan.
		Marine ecology The value of the ecological enhancements proposed for the IERRT have not been made clear and nothing has been further suggested in assessing the cumulative effect of both projects.	The enhancements proposed for IERRT are outside the scope of the Project and are subject to a separate application. The potential for the Project to cumulatively interact with IERRT has been extensively considered within the CEA and this assessment is presented within **Appendix 25.C [TR030008/APP/6.4]**.
		Conclusion We remain extremely concerned that the safety risks, in particular around the IOT trunkway have been scoped out of assessment are not being considered in cumulative effect. Mitigation is needed to address the cumulative effect which the IGET will have with the IERRT and robust measures need to put in place before IGET can go ahead.	The potential for the Project to cumulatively interact with IERRT has been extensively considered within the CEA, this is presented within **Appendix 25.C [TR030008/APP/6.4]**. As described within the Marine Transport and Navigation section of the CEA, the Project berth has been designed to be aligned with the existing Immingham Oil Terminal ("IOT") such that during operation it will not reduce the available channel width to the north. Vessels passing to the north will therefore be able to continue using the main channel. A proportion of these vessels may also pass the Project, but any effects of IERRT will be separate as it will be during a different part of their passage. In addition to the NRA, further assessments such as Quantitative Risk Assessment ("QRA") will be ongoing throughout the Project development to ensure all required mitigation measures are adopted to minimise the residual

Reference/Date	Consultee	Summary	How addressed in the CEA
			risk across all areas of the Project to ALARP. These studies will be contained within the COMAH Safety Report to be submitted to the COMAH Competent Authority.

25.3 Legislation, Planning Policy and Guidance

25.3.1 Due to the potential for cumulative and in-combination effects to occur as a result of the construction, operation and maintenance and eventual decommissioning of parts of the Project, a CEA has been undertaken as part of the Environmental Impact Assessment ("EIA") for the Project, in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ("EIA Regulations") (Ref 25-1) and the assessment requirements of the National Policy Statement for Ports ("NPSfP") (Ref 25-2).

25.3.2 The requirement for cumulative and in-combination impact assessments is stated in relevant legislation and policy documents and the CEA requirements and policies in the following documents have been reviewed:

a. The EIA Regulations (Rf 25-1);
b. The NPSfP (Ref 25-2);
c. The UK Marine Policy Statement (MPS) (Ref 25-5); and
d. Policy ECO1 of the East Inshore and East Offshore Marine Plan (Ref 25-6)

25.3.3 Schedule 4 paragraph 5 of the EIA Regulations (Ref 25-1) requires:

'*A description of the likely significant effects of the development on the environment resulting from, inter alia […] (e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources'.*

25.3.4 The EIA Regulations state that this description of likely significant effects 'should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development'.

25.3.5 Consideration has been given to the NPSfP (Ref 25-2) and relevant Marine Policy Statements ("MPS") with regard to the need for cumulative assessment.

25.3.6 Paragraph 4.7.1 of the NPSfP (Ref 25-2) states that:

'The Directive requires a description of the likely significant effects of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, positive and negative effects of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects. When considering a proposal, the decision maker should ensure that likely significant effects at all stages of the project have been adequately assessed and should request further information where necessary.'

25.3.7 Paragraph 4.7.3 of the NPSfP (Ref 25-2) goes on to state that when considering cumulative effects:

'The ES should provide information on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence). The decision-maker may also have other evidence before it, for example from appraisals of sustainability of relevant NPSs or development plans, on such effects and potential interactions. Any such information may assist the decision-maker in reaching decisions on proposals and on mitigation measures that may be required.'

25.3.8 Paragraph 2.4.3 of the UK MPS (Ref 25-5) states that:

'The marine plan authority will need to consider the potential cumulative impact of activities and, using best available techniques, whether for example:

a. *The cumulative impact of activities, either by themselves over time or in conjunction with others, outweigh the benefits;*
b. *A series of low impact activities would have a significant cumulative impact which outweighs the benefit;*
c. *An activity may preclude the use of the same area/resource for another potentially beneficial activity.'*

25.3.9 Policy ECO1 of the East Inshore and East Offshore Marine Plan (Ref 25-6) states:

'Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation.'

25.4 Assessment Methodology

25.4.1 There is no standard method for assessing cumulative and in-combination effects, therefore the CEA has been undertaken on a qualitative basis using a combination of professional judgement, and the results of the individual assessments (presented in **Chapters 6 - 24 [TR030008/APP/6.2]**). In particular, the Planning Inspectorate's Advice Note Seventeen (Ref 25-4) has been used to inform the scope of the CEA and to assist with the identification of relevant developments to include.

Assessment of In-combination Effects

25.4.2 The assessment of in-combination effects considers whether a single environmental receptor or resource would likely be affected by more than one source of effect from different aspects of the Project.

25.4.3 Potential interactions have been identified by reviewing the conclusions within the technical chapters (**Chapters 6 – 24 [TR030008/APP/6.2]**) in order to establish where individual impacts may combine and result in likely significant in-combination effects.

25.4.4 The study area for the assessment of in-combination effects is defined by the study areas presented in each of the environmental topics (**Chapters 6 - 24 [TR030008/APP/6.2]**). The sources of data used for the assessment of in-combination effects are the technical chapters presented within **Chapters 6 – 24 [TR030008/APP/6.2]**.

25.4.5 The assessment methodology for combined effects involved the identification of environmental resources and receptors where there is potential for more than one impact to be experienced and therefore potential for interactions between these. This enables the identification of the overall combined environmental effects of the Project. The environmental resource and receptor groups that have been identified and considered in relation to the potential for more than one type of impact to be experienced by a single receptor are presented within **Table 25-2**. This includes, but is not limited to, human receptors, ecological receptors, watercourses and users and operators of local businesses. Receptors that could be impacted by the Project as detailed in **Chapters 6 – 24 [TR030008/APP/6.2]** are indicated in the table by an 'X'. Information presented in **Table 25-2** has been compiled with input from those responsible for the production of the individual topic assessments. The table illustrates which environmental resources or receptors could be impacted by the effects reported in **Chapters 6 – 24 [TR030008/APP/6.2]**. Where any potential combination of effects has been identified, these have been assessed to determine whether in-combination effects are likely to occur.

25.4.6 **Table 25-2** identifies in blue where there is potential for an in-combination effect on a resource or receptor to arise from different environmental impacts. The table also identifies in grey where the assessment of environmental effects on a resource or receptor has been considered, and forms part of the main assessment, contained within **Chapters 6 - 24 [TR030008/APP/6.2]** (where residual effects are described for that resource or receptor type).

Table 25-2: Shared receptor list (grey fill indicates where the assessment of environmental effects on a resource or receptor is considered inherently within the main assessment, blue fill indicates where there is potential for an in-combination effect on a resource or receptor to arise).

Receptor	Technical Chapters																		Comment
	Air Quality	**Noise and Vibration**	**Terrestrial Ecology**	Marine Ecology	Ornithology	**Traffic and Transport**	Marine Transport and Navigation	**Landscape and Visual Impact**	**Historic Environment (Terrestrial)**	Historic Environment (Marine)	Physical Processes	Marine Water and Sediment Quality	Water Quality, Coastal Protection, Flood Risk and Drainage	Climate Change	Materials and Waste	Ground Conditions and Land Quality	Major Accidents and Disasters	Socio-Economics	Human Health and Wellbeing	
Residential/commercial Receptors	X	X				X		X					X				X	X	X	There is the potential for in-combination effects on residential receptors, this is assessed within **Table 25-6** to **Table 25-8.**
Human Health	X	X				X		X					X			X	X		X	Human health as a receptor is assessed within **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]** and is therefore not assessed further in this chapter.
Communities and local population	X	X				X		X									X	X	X	There is potential for in-combination effects on communities and the local population, this is assessed within **Table 25-6** to **Table 25-8.**
Public Rights of Way/Cycle Routes/Roads and Railways	X	X				X		X									X	X		There is potential for in-combination effects on PRoW/Cycle Route/Roads and Railways. This is assessed within **Table 25-6** to **Table 25-8.**
Historic Buildings/Features and Archaeological Sites		X	X					X	X	X							X			There is the potential for in-combination effects on historic buildings/features and archaeological sites. This is assessed within **Table 25-6** to **Table 25-8.**
Watercourses			X		X						X		X	X	X	X	X			There is potential for in-combination effects to impact watercourses as a result of the Project, these impacts are assessed within **Table 25-6** to **Table 25-8.**
Water and Sediment Quality											X	X	X		X	X	X			There is potential for in-combination effects to impact Water and Sediment Quality as a result of the Project, these impacts are assessed within **Table 25-6** to **Table 25-8.**
Benthic Habitats and Species		X		X							X	X					X			There is potential for in-combination effects to impact Benthic Habitats and Species as a result of the Project, these impacts are assessed within **Table 25-6** to **Table 25-8.**
Fish	X	X		X							X	X					X			There is potential for in-combination effects to impact fish as a result of the Project, however following a review of the topic-specific assessments, no potential for in-combination effects has been identified.

Receptor	Technical Chapters																		Comment
	Air Quality	**Noise and Vibration**	**Terrestrial Ecology**	Marine Ecology	Ornithology	**Traffic and Transport**	Marine Transport and Navigation	**Landscape and Visual Impact**	**Historic Environment (Terrestrial)**	Historic Environment (Marine)	Physical Processes	Marine Water and Sediment Quality	Water Quality, Coastal Protection, Flood Risk and Drainage	Climate Change	Materials and Waste	Ground Conditions and Land Quality	Major Accidents and Disasters	Socio-Economics	Human Health and Wellbeing	
Marine Mammals	X	X		X							X	X					X			There is potential for in-combination effects to impact marine mammals as a result of the Project, these impacts are reported in **Chapter 9: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** and assessed within **Table 25-6** to **Table 25-8.**
Coastal Waterbirds	X	X			X						X	X					X			There is potential for in-combination effects to impact coastal waterbirds as a result of the Project, these in-combination effects are assessed within **Table 25-6** to **Table 25-8.**
Breeding Birds	X	X			X						X						X			Although there is potential for in-combination effects to impact breeding birds as a result of the Project, following a review of the technical **Chapters 6**-**24** it has been identified that there would be no in-combination effects on this receptor.
Bats, Otters, Voles	X	X	X										X				X			Although there is potential for in-combination effects to impact bats, otters and voles as a result of the Project, following a review of the technical **Chapters 6**-**24** it has been identified that there would be no in-combination effects on this receptor.
Woodland and Designated Sites	X	X	X	X	X			X	X								X			Although there is potential for in-combination effects to impact woodland and designated sites as a result of the Project, following a review of the technical **Chapters 6** - **24** it has been identified that there would be no in-combination effects on this receptor.
Flood Defences													X				X			An assessment of the potential effects on Flood defences as a result of the Project is considered within **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2].** There is no potential for in-combination effects.
Geology																X				An assessment of the potential effects on Geology as a result of the Project is considered within **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2].** There is no potential for in-combination effects.

Receptor	Technical Chapters																		Comment
	Air Quality	**Noise and Vibration**	**Terrestrial Ecology**	Marine Ecology	Ornithology	**Traffic and Transport**	Marine Transport and Navigation	**Landscape and Visual Impact**	**Historic Environment (Terrestrial)**	Historic Environment (Marine)	Physical Processes	Marine Water and Sediment Quality	Water Quality, Coastal Protection, Flood Risk and Drainage	Climate Change	Materials and Waste	Ground Conditions and Land Quality	Major Accidents and Disasters	Socio-Economics	Human Health and Wellbeing	
Hydrogeology																X				An assessment of the potential effects on Hydrogeology as a result of the Project is considered solely within **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2].**
Soils/Groundwater													X			X				An assessment of the potential effects on soils/groundwater as a result of the Project is considered solely within **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2].**
Existing Development	X	X				X	X	X								X	X	X		There is potential for in-combination effects to impact Existing Development as a result of the Project. This has been assessed as part of the assessment for in-combination effects on 'residential receptors'. Where in-combination effects have been identified, they are assessed further within **Table 25-6** to **Table 25-8.**
Power/Gas Supplies																	X			An assessment of the potential effects on Power/Gas supplies as a result of the Project is considered solely within **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2].**
Global Climate														X						**Chapter 19: Climate Change [TR030008/APP/6.2]** includes an In-Combination Climate Change Impact ("ICCI") Assessment, which addresses the in-combination effects of a changing climate and the Project on receptors in the surrounding environment. This is therefore not considered further within this assessment.
Landfill, Safeguarded/ Allocated Mineral and Waste Sites															X					The effect of the Project on landfill, safeguarded/allocated mineral and waste sites is considered solely within **Chapter 20: Materials and Waste [TR030008/APP/6.2]** and is therefore not assessed further in this Chapter.

25.4.7 The potential interactions between individual effects have been identified by reviewing the conclusions of the assessments within the topics presented in **Chapters 6 - 24 [TR030008/APP/6.2]**. Some of these chapters have already addressed interactions between different types of impact relating to specified environmental resources and receptors, and this is described within the technical chapters **[TR030008/APP/6.2]**:

a. Where a resource or receptor is shown to only have a potential in-combination effect with the Major Accidents and Disasters, Human Health or Marine Transport and Navigation assessments, it has been considered in **Chapter 22: Major Accidents and Disasters, Chapter 24: Human Health and Wellbeing and Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]**, respectively, and has not been considered further in this assessment.

b. **Chapter 9: Nature Conservation (Marine Ecology) and Chapter 10: Ornithology [TR030008/APP/6.2]** include an assessment of the potential impacts of air quality, dust and noise impacts and therefore how they could (in combination with other ecological impacts, such as habitat loss) affect ecological receptors.

c. All effects on the designated features of the Humber Estuary European Marine Site ("EMS") are assessed in **Chapter 9: Nature Conservation (Marine Ecology)** and **Chapter 10: Ornithology [TR030008/APP/6.2]** respectively.

d. The potential for significant effects resulting from changes in physical processes on other environmental features/receptors have been assessed in other topic-specific ES chapters, including **Chapter 9: Nature Conservation (Marine Ecology); Chapter 10: Ornithology; Chapter 15: Historic Environment (Marine); Chapter 17: Marine Water and Sediment Quality; and Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2].**

e. **Chapter 18: Water Use, Water Quality, Coastal Protection and Flood Risk [TR030008/APP/6.2]** considers the potential impact of climate change upon flood risk.

f. **Chapter 19: Climate Change [TR030008/APP/6.2]** includes an ICCI Assessment, which addresses the in-combination effects of a changing climate and the Project on receptors in the surrounding environment. Potential ICCIs have been assessed by technical disciplines and collated within **Chapter 19: Climate Change [TR030008/APP/6.2]**.

25.4.8 The effects due to the interaction of different types of impact which form an inherent part of the technical assessments listed above are not included within this in-combination effects assessment. The in-combination effects assessment considers only those effects which could arise as a result of multiple impacts on single receptors which have not been identified elsewhere within this ES **[TR030008/APP/6.2]**.

25.4.9 As shown in **Table 25-2**, the following resources and receptors have been identified to have no potential to experience inter-relationship effects and are therefore not considered further within this assessment:

a. Human Health (the assessment of in-combination effects on human health is considered inherently within **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]**);

b. Flood defences;

c. Geology;

d. Hydrogeology;

e. Power/Gas supplies;

f. Global Climate; and

g. Landfill, Safeguarded/Allocated Mineral and Waste Sites

25.4.10 The remaining receptors/resources have been considered within the in-combination effects assessment (presented in **Section 25.5**). Within this in-combination effects assessment, receptors and/or resources experiencing effects of minor or greater magnitude only (as classified in the main topic assessments contained within **Chapters 6 - 24 [TR030008/APP/6.2]**) have been considered.

Assessment of Cumulative Effects

25.4.11 The assessment of cumulative effects considers the effects on environmental resources and receptors that will likely occur from the changes arising from the Project in conjunction with those associated with other planned developments.

25.4.12 A combination of professional judgement and established guidance has been used to confirm the scope of the cumulative effects assessment and to aid the identification and (where necessary) mitigation of likely significant effects.

25.4.13 With regard to cumulative effects, the ability to quantify the extent to which the environmental effects of other schemes can interact with those associated with the Project depends upon the level of information available regarding such other schemes. Where environmental assessment information regarding other schemes is not available, is limited or is uncertain, the cumulative assessment has necessarily been qualitative in nature using professional opinion.

25.4.14 When considering cumulative effects, the mitigation measures set out in **Chapters 6 - 24 [TR030008/APP/6.2]** have been taken into account (i.e. only the residual effects of the Project have been considered within the assessment). Cumulative and in-combination effects will be assessed to be negligible, minor, moderate, large or very large. Moderate, large or very large effects are considered to be significant, using the methodologies outlined in each technical chapter (refer to **Chapters 6 - 24 [TR030008/APP/6.2]**).

25.4.15 In accordance with the approach contained within the Inspectorate's Advice Note Seventeen (Ref 25-4), the approach to the CEA follows a staged approach, as summarised in **Plate 25-1**.

Plate 25-1 Staged Approach to the Cumulative Assessment

Stage 1: Establishing the long list of 'other existing development and/or approved development'

25.4.16 Stage 1 activities focused on establishing the Project's Zone of Influence ("ZoI"). The ZoI used for this CEA was derived from the study areas associated with the environmental topics assessed within the EIA. **Table 25-3** presents the ZoIs that were identified within each environmental topic and used for the final cumulative assessment.

Table 25-3: Summary of indicative Zones of Influence (ZoIs)

Environmental Topic	ZoIs Applied to the Assessment of Cumulative Effects
Air Quality	**Construction:** Within 350m of the Site Boundary and/or 50m of a public road used by construction vehicles that is within 500m of a site access point, and where there are sensitive ecological receptors within 50m of the Site Boundary and/or 50m of a public road used by construction vehicles that is within 500m of a site access point. **Operation**: The ZoI for onsite point source emissions during operation which includes worst-case human health, nature conservation and vessel emission impacts within 10km of the emissions sources. **Operational traffic-related Air Quality:** 200m from affected road links[1]

[1] Affected roads are roads which are predicted by the traffic model to exceed threshold increases in traffic flows—as set by the Guidelines for the Environmental Assessment of Road Traffic (IEMA, 2003)—and where receptors have been identified that would be affected by the increases. Full details can be found in paragraphs 6.5.3 and 6.5.4 of **Chapter 11: Traffic and Transport [TR030008/APP/6.2].**

Environmental Topic	ZoIs Applied to the Assessment of Cumulative Effects
	As the construction phase traffic data includes traffic associated with other developments, the air quality impacts assessment of traffic-related construction impacts reported in **Chapter 6: Air Quality [TR030008/APP/6.2]**, is inherently cumulative. There is therefore no separate assessment of cumulative air quality construction traffic-related impacts included in this ES. Refer to **Chapter 6: Air Quality [TR030008/APP/6.2]** for more information.
Noise and Vibration	**Construction Noise and Vibration and Operational Noise**: 500m ZoI from the Site Boundary. The construction phase traffic model includes traffic associated with other developments, the noise and vibration assessment of construction-related traffic noise reported within **Chapter 7: Noise and Vibration [TR030008/APP/6.2]** is inherently cumulative. Any effects due to operational vibration were scoped out of further assessment (refer to **Chapter 7: Noise and Vibration [TR03008/APP/6.2]**, therefore no assessment of cumulative operational vibration effects has been undertaken. Refer to **Chapter 7: Noise and Vibration [TR030008/APP/6.2]** for more information.
Nature Conservation (Terrestrial)	**Construction and Operation:** 2km from the Site Boundary Refer to **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2]** for more information.
Nature Conservation (Marine)	**Construction and Operation:** 10km ZoI for International and National nature conservation designations. **Construction and Operation:** The ZoI for all other nature conservation and marine ecology effects is focused on the Port of Immingham and proposed disposal sites. Refer to **Chapter 8: Nature Conservation (Marine Ecology) [TR030008/APP/6.2]** for more information.
Ornithology	**Construction and Operation:** 10km ZoI for International and National nature conservation designations. **Construction and Operation:** The ZoI for all ornithology effects is focused on the Port of Immingham area. Refer to **Chapter 10: Ornithology [TR030008/APP/6.2]** for more information.
Traffic and Transport	The effects of construction traffic have been assessed to include any traffic that would be generated by committed 'other developments'. The assessment of construction traffic effects is therefore inherently cumulative. Further details are presented in **Chapter 11: Traffic and Transport [TR030008/APP/6.2].**
Marine Transport and Navigation	**Construction and Operation:** The study area has been defined as the area comprising the Humber Estuary bounded on the west by the Humber Bridge and on the east by the Humber Estuary Services Statutory Harbour Authority (SHA) limit for the Humber Estuary Refer to **Chapter 12: Marine Transport and Navigation [TR030008/APP/6.2]** for more information.

Environmental Topic	ZoIs Applied to the Assessment of Cumulative Effects
Landscape and Visual Impact	**Construction and Operation:** 3km from the Site Boundary Refer to **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]** for more information.
Historic Environment (Terrestrial)	**Construction and Operation:** 2km from the Site Boundary Refer to **Chapter 14: Historic Environment (Terrestrial) [TR030008/APP/6.2]** for more information.
Historic Environment (Marine)	**Construction and Operation:** 2km from the Site Boundary Refer to **Chapter 15: Historic Environment (Marine) [TR030008/APP/6.2]** for more information.
Physical Processes	**Construction and Operation:** ZoI defined as the Project site, adjacent Immingham Coastline, existing jetties, the area between the sunk dredged channel and Halton middle and the proposed spoil grounds. Refer to **Chapter 16: Physical Processes [TR030008/APP/6.2]** for more information.
Marine Water and Sediment Quality	**Construction and Operation:** The ZoI is considered to be the Site and the adjacent Immingham coastline, the existing jetties across the near-field and the central part of the Humber Estuary, generally between Sunk Chanel and Halton Middle. Within the far-field region, the study area includes the wider Humber Estuary from the mouth up to estuary of the Hull Bend. Refer to **Chapter 17: Marine Water and Sediment Quality [TR030008/APP/6.2]** for more information.
Water Quality, Coastal Protection, Flood Risk and Drainage	**Construction and Operation:** 1km from the Site Boundary Refer to **Chapter 18: Water Use, Water Quality, Coastal Protection, Flood Risk and Drainage [TR030008/APP/6.2]** for more information.
Climate Change	N/A – due to the receptor for emissions of greenhouse gases being the entire global climate and therefore sources of emissions for assessment should not be constrained within a geographically defined location. Therefore, a detailed cumulative effects assessment has not been undertaken for Climate Change. Refer to **Chapter 19: Climate Change [TR030008/APP/6.2]** for more information.
Materials and Waste	N/A as the assessment is considered inherently cumulative – this is due to Waste Planning Authorities accounting for additional provision of waste as a result of local development within their Waste Management Plans. This therefore does not need to be, duplicated as part of the CEA process. Refer to **Chapter 20: Materials and Waste [TR030008/APP/6.2]** for more information.
Ground Conditions and Land Quality	**Construction and Operation:** 500m from the Site Boundary for geology and soil resources and 1km from the Site Boundary for the assessment of effects to controlled waters.

Environmental Topic	ZoIs Applied to the Assessment of Cumulative Effects
	Refer to **Chapter 21: Ground Conditions and Land Quality [TR030008/APP/6.2]** for more information.
Major Accidents and Disasters	**Construction and Operation:** 5km from the Site Boundary Refer to **Chapter 22: Major Accidents and Disasters [TR030008/APP/6.2]** for more information.
Socio-economics	**Construction and Operation:** 500m from the Site Boundary for Public Rights of Way, 500m from the Site boundary for residential receptors and businesses, 1.5km from the Site boundary for community facilities and 5km from the site boundary for the influx of new workers and impacts on schools/GPs in the area. Refer to **Chapter 23: Socio-economics [TR030008/APP/6.2]** for more information.
Human Health and Wellbeing	The Human Health cumulative ZoI is representative of the study area presented in **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]** which is informed by other ES chapters and therefore varies depending on the receptor in question. The maximum study area relates to primary healthcare facilities which is set at 5km from the Site. Refer to **Chapter 24: Human Health and Wellbeing [TR030008/APP/6.2]** for more information.

25.4.17 The Traffic and Transportation assessment (**Chapter 11: Traffic and Transport [TR030008/APP/6.2]**) assesses the impacts of construction traffic in the year of peak construction for the Project (2026), for the road links listed below:

a. A180 East – between east of the A180/A1173 Junction;
b. A1173 – between A1173/Kiln Lane and A1173/Kings Road;
c. Queens Road - between A1173/Kings Road and Queens Road/Laporte Road;
d. Kings Road - between A1173/Kings Road and Kings Road/Pelham Road;
e. Manby Road - between A160/Manby Road and Kings Road/Pelham Road;
f. A160 - between Manby Road/A160 and A160/A1077 roundabout;
g. A160 - between A160/A1077 roundabout and A160/A180;
h. A180 West - between A180/ A1173 and A180/ A160; and
i. Laporte Road – between Queens Road and Kiln Lane/Hobson Way roundabout

25.4.18 The 2026 baseline traffic against which the effects of construction traffic have been assessed includes any traffic that would be generated by committed 'other developments'. The assessment of construction traffic effects is therefore inherently cumulative. Further details are presented in **Chapter 11: Traffic and Transport of the ES [TR030008/APP/6.2]**.

25.4.19 A detailed cumulative effect assessment has not been undertaken for Climate Change due to the receptor for emissions of greenhouse gases being the entire global climate and therefore sources of emissions for assessment should not be constrained within a geographically defined location. A detailed cumulative effect assessment for climate change is also not reasonably practicable due to the difficulties in accessing reliable future emissions data for other developments. Further information on this is presented in the Climate Change cumulative effects section of **Appendix 25.C [TR030008/APP/6.4]**.

25.4.20 A detailed cumulative effects assessment has not been undertaken for Materials and Waste due to Waste Planning Authorities accounting for additional provision of waste as a result of local development within their Waste Management Plans. This therefore does not need to be, in effect, duplicated as part of the CEA process. Further information on this is presented in the Materials and Waste cumulative effects section of **Appendix 25.C [TR030008/APP/6.4]**.

25.4.21 A detailed cumulative impact assessment has not been undertaken for Nature Conservation (Terrestrial) ecology impacts, because the assessment has not identified any impacts on terrestrial ecology receptors that could occur beyond the Project boundary. There is therefore no potential for the impacts of the Project to combine with effects from any other plan or project identified within the list of cumulative projects.

25.4.22 The study area for the consideration of cumulative effects has been developed by taking into account the predicted ZoI for each technical discipline as reported (**Chapters 6 to 24 [TR030008/APP/6.2]**). The largest ZoI within the ES technical assessments is 10km for the assessment of air quality effects on nature conservation receptors and potential ecological impacts to internationally designated sites. As a result, the maximum ZoI used for the cumulative assessment is 10km. The areas of search within this maximum ZoI were then varied depending upon the type and scale of development as follows:

a. 10km –NSIPs (based on potential air quality and marine ecological effects in accordance with standard guidance);

b. 5km – Major developments (as defined in section 2 of The Town and Country Planning (Development Management Procedure) (England) Order 2015) (Ref 25-7);

c. 5km – Marine licence activities/development;

d. 5km – Local plan allocations (adopted and emerging); and

e. 1km – Non-major development (other development which does not meet the criteria for major development (excludes very small scale development such as domestic extensions or garages, for which cumulative effects are unlikely to arise when considered alongside another development)

Initial Long List of Developments

25.4.23 An initial long list of other developments in the vicinity of the Project was identified following a search of the relevant planning databases (e.g. National

Infrastructure Planning Portal, NELC's Planning Portal and the Marine Management Organisation's license application portal).

25.4.24 This initial search focused on developments within the 10km search area which meet the criteria outlined above. This preliminary search, based on information available from local authority online planning portals, the National Infrastructure Planning Portal and the Marine Management Organisation's license application portal, was subsequently extended as further work was undertaken during the EIA process, to capture other developments within the adopted areas of search, and to ensure the most up to date information was used to inform the EIA.

25.4.25 During the completion of the ES, the long list of other developments continued to be reviewed and updated with any additional developments or relevant information that emerged, up until an assessment cut-off date of the start of July 2023.

25.4.26 Each development within the long list was reviewed to determine its status at the time of undertaking the assessment (July 2023) and was assigned a final status and tier (from Tier 1 (most certain), to Tier 3, (least certain)), as described in **Table 25-4**, informed by the guidance and levels presented within Advice Note seventeen (Ref 25-4). The long list of planned developments and development allocations and their assigned tiers are presented in **Appendix 25.A [TR030008/APP/6.4]**).

Table 25-4 Development Tier in Accordance with Advice Note Seventeen

Tier	Degree of Certainty
Tier 1	• Development currently under construction. • Approved applications which have not yet been implemented (covering the past five years and taking account of those that received planning consent over three years ago and are still valid but have not yet been completed). • Submitted applications not yet determined. • Refused applications, subject to appeal procedures not yet determined.
Tier 2	• Developments on the National Infrastructure Planning Programme of Projects (if a Scoping Report has been submitted).
Tier 3	• Developments on the National Infrastructure Planning Programme of Projects (if a Scoping Report has not been submitted). • Development identified in the relevant Development Plan (and emerging Development Plans). • Development identified in other plans and programmes which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

25.4.27 For planning applications that have submitted a variation application both the original application and the variation have been considered.

25.4.28 The potential for cumulative effects to arise as a result of the decommissioning phase of the Project have not been assessed within the CEA due to this being a minimum of 25 years into the future. When the Project is due to be decommissioned, the other developments are likely to be different from those assessed currently and therefore new or different cumulative effects could be present. Cumulative effects associated with decommissioning would, therefore, be considered at that point in time.

25.4.29 Consultation with NELC has taken place throughout the pre-application phase, such as through the Scoping Opinion (presented within **Appendix 1.B [TR030008/APP/6.4]**) and Statutory Consultation for the Project. The long list used for the CEA was sent to NELC for comment, and a response was provided on 27 June 2023. NELC recommended that Scheme ID 116 be included within the shortlist of cumulative schemes. Scheme ID 116 has therefore been included and assessed as part of this CEA.

Stage 2: Establishing a shortlist of 'other existing development and/or approved development'

25.4.30 At Stage 2, any development of a nature or scale without the potential to result in cumulative impacts has been excluded with due consideration given to the likely ZoI for each environmental topic.

25.4.31 The criteria used to determine whether to include or exclude other existing development and/or approved development from the shortlist, based on the guidance provided in the Planning Inspectorate's Advice Note Seventeen (Ref 25-4), is detailed below:

a. **Temporal scope:** Considering the relative construction, operation or decommissioning programmes of the 'other existing development and/or approved development' identified as part of Stage 1 and establishing whether there is an overlap or any potential for interaction with the Project.

b. **Scale and nature of development:** Considering whether the scale and nature of the 'other existing development and/or approved development' identified at Stage 1 are likely to interact with the Project.

c. **Source-pathway-receptor linkages:** Considering any other factors such as the nature and/or capacity of the receiving environment that would make a significant cumulative effect as a result of the Project and developments identified in Stage 1 more or less likely utilising a source-pathway-receptor approach.

25.4.32 Land allocations without supporting planning applications have not been considered as there is no certainty that developers will come forward with projects within the timescale for the delivery of these sites and the nature for such projects and their associated environmental effects are currently unknown.

25.4.33 Developments that are already in existence i.e. those which are completed and operational, and those that are expected to be completed prior to the Project construction are considered to form part of the environmental baseline and future baseline conditions within which the Project will be implemented. The cumulation

of effects associated with such existing developments has therefore been accounted for through establishment of the current baseline within each technical assessment presented in **Chapters 6 – 24 [TR030008/APP/6.2]** and were therefore not considered for shortlisting.

25.4.34 Where individual technical disciplines have scoped out assessment of developments included on the shortlist for the purposes of their cumulative assessment, the reasoning for this is set out within the Stage 4 CEA presented in **Appendix 25.C [TR030008/APP/6.4]**.

Stage 3: Information Gathering

25.4.35 Stage 3 has involved reviewing the available information relating to shortlisted developments in order to establish the details of their likely environmental effects.

25.4.36 Information relating to the shortlisted developments has been collected from the appropriate sources including the local planning authority websites, the Inspectorate's website or directly from the applicant/developers, and has included, but not been limited to:

a. Proposed design and location information;
b. Proposed programme of demolition, construction, operation and/or decommissioning; and
c. Environmental assessments that set out baseline data and effects arising from 'other development'.

Stage 4: Assessment

25.4.37 Those developments which are shortlisted in Stage 2 and have available information gathered at Stage 3 have been incorporated into the CEA. This has involved identifying where cumulative effects are likely to occur and assessing the significance of those effects on environmental receptors and resources, taking into account any defined mitigation measures.

25.4.38 The criteria for determining the significance of any potential cumulative effect has been based upon:

a. The duration of effect i.e. whether it would be temporary or permanent;
b. The extent of effect i.e. the geographical area of an effect;
c. The type of effect i.e. whether additive or synergistic;
d. The frequency of the effect;
e. The 'value' and resilience of the receptor affected; and
f. The likely success of mitigation on the Project and the developments included within the CEA.

25.4.39 The assessment has been documented in a matrix in accordance with Matrix 2 in Appendix 2 of the Planning Inspectorate's Advice Note Seventeen (Ref 25-4).

Impact Assessment Significance Criteria

25.4.40 The significance of potential in-combination and cumulative effects upon environmental receptors and resources has been determined using a combination of the criteria set out in **Table 25-5**, below and professional judgement, assisted by the views and opinions of the competent experts responsible for undertaking the topic assessments. In some cases, the assessment may deviate from the specific criteria outlined in **Table 25-5**. Where this is the case, professional judgement and competent expert advice will have been used to inform the outcome.

Table 25-5 Classification of In-combination and Cumulative Effects

Effect Classification	Typical Descriptors of Effect
Very large (typically adverse only)	Where the combined effects of the Proposed Development upon an individual or collection of environmental receptors would result in a very highly significant (beneficial or adverse, though typically adverse only) effect. Effects would be due to permanent impacts for receptors of very high value.
Large (adverse or beneficial)	Where the combined effects of the Proposed Development upon an individual or collection of environmental receptors would result in a highly significant (beneficial or adverse) effect. Effects would be due to impacts which would be, e.g.: • widespread/large scale for a receptor of high value[2]; • permanent for a receptor or receptors of high value; • localized for a receptor or receptors of very high value; or • temporary for a receptor or receptors of very high value
Moderate (adverse or Beneficial)	Where the combined effects of the Proposed Development upon an individual or collection of environmental receptors would result in a significant (beneficial or adverse) effect. Effects would be due to impacts which would be, e.g.: • permanent for a receptor or receptors of medium value; • localized for a receptor or receptors of high value; or • temporary for a receptor or receptors of high value.
Minor (adverse or beneficial)	Where the combined effects of the Proposed Development upon an individual or collection of environmental receptors would result in a beneficial or adverse effect. Effects would be due to impacts which would be e.g.: • permanent for receptors of low value; • localized for a receptor or receptors of medium value; or • temporary for a receptor or receptors of medium value.

[2] 2 Note that the term 'value' refers here to both intrinsic value and sensitivity.

Effect Classification	Typical Descriptors of Effect
Neutral/ Negligible (adverse or beneficial)	Where the combined effects of the Proposed Development upon an individual or collection of environmental receptors would result in a negligible and not significant (beneficial or adverse) effect.

25.4.41 In determining the possible significance of cumulative effects, the location and timing of the identified other developments and their associated impacts/ effects have been taken into account wherever possible.

25.4.42 The cumulative effects assessment only considers those receptors that would experience a residual effect that is more than negligible associated with the Project. For receptors where the Proposed Development's residual effects are assessed to be neutral/ negligible, it is considered that such receptors could not experience cumulative effects.

25.4.43 In-combination and cumulative effects that are moderate, large or very large are considered significant effects in relation to the EIA Regulations.

25.4.44 In some cases, an effect on a receptor is judged to increase or intensify as a result of cumulative or in-combination effects between the Project and other developments but is not considered to be at a level different to the effect category reported in the technical environmental assessment as a result of the Project alone. Therefore, the presence of a significant effect in the core topic assessment would likely result in a significant cumulative or in-combination effect being reported even though the magnitude of impact is only marginally worse than the core assessment and in some cases at a level which would not change the level of effect assessed for the Project alone. Where this is the case, this has been clarified within the assessment contained in **Section 25.5** of this chapter for In-combination effects and in **Appendix 25.C [TR030008/APP/6.4]** for cumulative effects.

25.4.45 The approach taken to assess the cumulative effects as provided in **Appendix 25.C [TR030008/APP/6.4]** follows the approach as outlined above in this chapter, however in some instances certain topics have deviated to align with the methodology outlined within their relevant ES chapter due to topic specific guidance. In addition, certain topic cumulative assessments have assessed the interaction of all or a group of the shortlisted cumulative developments alongside the Project occurring at the same time. This is the case for Landscape and Visual and Socio-economics as it is considered to be an appropriate approach in determining the likelihood for significant effects to occur. However, where topics have not taken this approach, it is considered that the interaction between the Project and specific other development would not result in a materially different/ greater cumulative effect should the approach described above be adopted.

25.5 In-Combination Effects Assessment

25.5.1 Details of the in-combination effects assessment are discussed in the sections below. The assessment considers each environmental topic presented within this

ES (**Chapters 6 – 24 [TR030008/APP/6.2]**) and potential impacts upon a 'Shared Receptor List', presented within **Table 25-2**. The outcomes of the in-combination effects assessment are summarised in **Table 25-6** to **Table 25-8**.

25.5.2 Each of the technical assessments reported in the ES **[TR030008/APP/6.2]** has identified effects which may occur as result of the Project, ranging from negligible or minor (not significant) to moderate and large (significant). Multiple effects upon one or more common receptors could theoretically interact or combine, to result in an in-combination effect which is more/or less significant than the effects individually. As described in **Section 25.4**, only receptors and/or resources experiencing a minor effect and above are included within this in-combination effects assessment.

25.5.3 As described in **Section 25.4**, some of the technical assessments have already assessed effects that result from the combination or interaction of different types of impacts on individual receptors. Any effects arising from the interaction of impacts on individual receptors which have already been assessed within the technical assessments are not repeated here. This section considers only those in-combination effects which have not been identified elsewhere within the technical assessments.

25.5.4 When considering in-combination effects, the mitigation measures as set out in **Chapters 6 – 24 [TR030008/APP/6.2]** (including embedded mitigation measures built into the Project's design and measures embedded in the **Outline Construction Environmental Management Plan ("Outline CEMP") [TR030008/APP/6.5]**) must be taken into account. Therefore, only residual effects (post-mitigation) are considered.

25.5.5 Mitigation of any combined effects identified is best achieved through management and control measures employed to prevent or reduce the individual effects in the first instance, these measures are outlined in the ES **Chapters 6 – 24 [TR030008/APP/6.2]** thereby reducing the likelihood of the effects interacting and combining.

25.5.6 The following sections provide a qualitative assessment of the potential for in-combination effects to arise, following a review of ES **Chapters 6 - 24 [TR030008/APP/6.2]**.

Table 25-6: Summary of in-combination effects (construction)

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
31 Queens Road and other residential properties along Queen's Road, eastern end Type of receptor: Residential Noise receptor: NSR1 Representative viewpoint: VP11 Traffic and transport receptor: Link 3	High	**Dust:** Minor adverse **Noise** (Landside construction): Minor adverse **Noise (Construction Traffic):** Minor adverse **Vibration:** Minor adverse **Visual**: Major adverse **Traffic and transport:** Minor adverse **Floodplain inundation from tidal flooding, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain:** negligible/minor adverse.	Temporary	Local	In-combination effects are assessed to occur on 31 Queen's Road and other residential properties along Queen's Road (eastern end) as a result of construction dust, noise (both landside construction and construction traffic), vibration, visual effects resulting from the potential views of construction activity, traffic and transport, and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **Large adverse (significant)**. This effect is no worse than the major adverse visual effect in isolation.	As the residual in-combination effect is driven by the major adverse visual effect, the in-combination effect is no worse than the effect in isolation. This effect in isolation has been mitigated as far as appropriate. Therefore, no additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Large adverse (significant)**
1 Queens Road and other residential properties along Queen's Road, western end Type of receptor: Residential Noise receptor: NSR2 Representative viewpoint: VP11 Traffic and transport receptor: Link 3	High	**Dust:** Minor adverse **Noise** (Landside construction): Minor adverse **Noise (Construction Traffic):** Minor adverse **Vibration:** Minor adverse **Visual**: Major adverse **Traffic and transport:** Minor adverse **Floodplain inundation from tidal flooding, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain:** negligible/minor adverse.	Temporary	Local	In-combination effects are assessed to occur on 1 Queen's Road and other residential properties along Queen's Road (western end) as a result of construction dust, noise (both landside construction and construction traffic), vibration, visual effects resulting from the potential views of construction activity, traffic and transport, and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **Large adverse (significant)**. This effect is no worse than the major adverse visual effect in isolation.	As the residual in-combination effect is driven by the major adverse visual effect, the in-combination effect is no worse than the effect in isolation. This effect in isolation has been mitigated as far as appropriate. Therefore, no additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Large adverse (significant)**
Residential properties on Chestnut Avenue, Waterworks Street and Spring Street (East of Immingham) Type of receptor: Residential Representative viewpoint: VP5 Noise Receptor: NSR3	High	**Dust:** Minor adverse **Visual**: Minor adverse **Floodplain inundation from tidal flooding, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain:** negligible/minor adverse.	Temporary	Local	In-combination effects are assessed to occur residential properties along Chestnut Avenue, Waterworks Street and Spring Street as a result of construction dust, visual effects resulting from the potential views of construction activity, increases in flood risk and landside construction noise. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised, therefore the overall in-combination effect on	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the	**Minor adverse (not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
		Noise (Landside construction): Negligible/minor adverse			these receptors is assessed to be **minor adverse (not significant)**.	**Outline CEMP [TR030008/APP/6.5]**.	
Residential properties on Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk and Kendal Road (East of Immingham) Type of receptor: Residential Noise receptor: NSR4	High	**Dust:** minor adverse **Floodplain inundation from tidal flooding, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain:** negligible/minor adverse. **Noise** (Landside construction): Negligible/minor adverse	Temporary	Local	In-combination effects are assessed to occur residential properties along Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk and Kendal Road as a result of construction dust, landside construction noise and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **minor adverse (not significant)**.	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor adverse (not significant)**
Commercial receptors along Queen's Road Type of receptor: Commercial Representative Viewpoint: VP11	Low	**Visual**: Major adverse **Floodplain inundation from tidal flooding, alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain:** negligible/minor adverse.	Temporary	Local	In-combination effects are assessed to occur on commercial receptors along Queen's Road as a result of visual effects resulting from the potential views of construction activity and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised. The overall in-combination effect on these receptors is assessed to be **large adverse (significant)**. This effect is no worse than the major adverse visual effect in isolation.	As the residual in-combination effect is driven by the major adverse visual effect, the in-combination effect is no worse than the effect in isolation. This effect in isolation has been mitigated as far as appropriate. Therefore, no additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Large adverse (significant)**
PRoW (Bridleway 36 and the proposed England Coastal Path) Representative Viewpoint: VP2 and VP3	Medium	**Visual**: Major adverse **Socio-economics:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur on Bridleway 36 and the proposed England Coastal Path as a result of visual effects resulting from the potential views of construction activity, socio-economics and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **large adverse (significant)**. This effect is no worse than the major adverse visual effect in isolation.	As the residual in-combination effect is driven by the major adverse visual effect, the in-combination effect is no worse than the effect in isolation. This effect in isolation has been mitigated as far as appropriate. Therefore, no additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the	**Large adverse (significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
						Outline CEMP [TR030008/APP/6.5].	
North Beck Drain Type of receptor: watercourse	High	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse **Surface water contamination:** Minor adverse (not significant)	Temporary	Local	In-combination effects are assessed to occur on the North Beck Drain as a result of the potential impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor adverse (not significant)**
Habrough Marsh Drain Type of receptor: watercourse	High	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse **Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk:** Minor adverse **Surface water contamination:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur on the Habrough Marsh as a result of the potential impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor Adverse (not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
Local Drains (including Immingham Pump Drain) Type of receptor: watercourse	Medium	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse.	Temporary	Local	In-combination effects are assessed to occur on Local Drains as a result of the potential impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor Adverse (not significant)**
Benthic habitats and species Type of receptor: ecological	High	**Changes to benthic habitats and species as a result of seabed material during dredging:** insignificant/minor adverse **Introduction and spread of non-native species**: insignificant /minor adverse	Temporary	Local	The capital dredge and ongoing maintenance dredging have the potential to result in combined effects on subtidal habitats and species with respect to habitat change. Following the cessation of capital dredging, a broadly similar benthic assemblage would be expected to occur as a result of recolonisation which would occur relatively quickly (with populations of infaunal species in the area known to fully re-establish in typically less than 1-2 years and for some species within a few months). Maintenance dredging is expected to be to be very limited (if required at all). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements but is anticipated there could be several years or more between maintenance dredge campaigns if required at all). On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of the maintenance dredging area between maintenance dredging campaigns. Cumulative effects could also occur due to introduction and spread of non-native species during construction and operation. However, biosecurity control measures will be implemented during both phases to minimise the risk. Following the impact assessment methodology, the probability of occurrence and of cumulative impact pathways interacting is considered to be high but the magnitude of change will be small at worst with the application of the proposed measures. The exposure to change is, therefore, assessed as low. Given the overall low to moderate sensitivity of benthic habitats and species with the mitigation measures in place, and their moderate to high importance (depending on the nature conservation value of individual habitats and species), the potential cumulative and in-	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Negligible to minor adverse (not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
					combination effects are assessed as negligible to minor adverse and not significant.		
Fish Type of receptor: ecological	High	**Effect of underwater noise disturbance and vibration during piling, capital dredging and dredge disposal:** Minor adverse	Temporary	Local	Piling could potentially occur concurrently with capital dredging during construction which could result in potential cumulative underwater noise effects on fish. However, capital dredging is only expected to cause behavioual reactions in a relatively localised area in the vicinity of the dredger and is expected to be of a similar magnitude to noise from maintenance dredging vessels and ships operating in the local area. Furthermore, any cumulative/in-combination effects on fish will be temporary, only occurring for the duration of construction, and the baseline situation will fully return upon cessation of the works. Following the impact assessment methodology, the probability of occurrence of a cumulative effect is considered to be high but the magnitude of change will be small at worst with the application of the proposed piling mitigation measures. The exposure to change is, therefore, assessed as low. Given the overall low to moderate sensitivity of fish with the mitigation measures in place, and their low to high importance (depending on the nature conservation and/or commercial value of individual species), the potential cumulative and in-combination effects are assessed as insignificant to minor adverse and not significant.	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor adverse** **(not significant)**
Marine Mammals Type of receptor: ecological	High	**Effect of underwater noise disturbance and vibration during piling, capital dredging and dredge disposal:** Minor adverse	Temporary	Local	Piling could potentially occur concurrently with capital dredging during construction which could result in potential cumulative underwater noise effects on marine mammals. However, capital dredging is only expected to cause behavioural reactions in a relatively localised area in the vicinity of the dredger and is expected to be of a similar magnitude to noise from maintenance dredging vessels and ships operating in the local area. Furthermore, any cumulative/in-combination effects on marine mammals will be temporary, only occurring for the duration of construction, and the baseline situation will fully return upon cessation of the works. Following the impact assessment methodology, the probability of occurrence of a cumulative effect is considered to be high but the magnitude of change will be small at worst with the application of the proposed piling mitigation measures. The exposure to change is, therefore, assessed as low. Given the overall low to moderate sensitivity of marine mammals with the mitigation measures in place, and high importance (depending on the nature conservation and/or commercial value of individual species), the potential in-combination effects are assessed as insignificant to minor adverse and not significant.	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor adverse** **(not significant)**
Coastal waterbirds Type of receptor: ecological	High	**Effect of airborne noise and visual disturbance to coastal waterbirds using intertidal:** minor adverse	Temporary	Local	There is the potential for in-combination effects related to potential noise and visual disturbance during construction and operation. However, the proposed construction mitigation measures are considered to be effective in minmising potential disturbance effects to coastal waterbirds during this phase. Operational	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including	**Minor adverse** **(not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
					disturbance responses are expected to be relatively limited. On this basis, the potential cumulative and in-combination effects are assessed as **minor** adverse and not significant.	implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	
Long Strip **(Mature deciduous woodland, heritage asset)** Type of receptor: ecological/heritage	Low	**Pipe-rack and jetty access road construction resulting in loss of/ damage to woodland habitat:** moderate adverse **Pipe-rack and jetty access road construction resulting in impacts to the setting of the historic asset:** minor adverse	Permanent	Local	In-combination effects are assessed to occur on the 'Long Strip' woodland as a result of the construction of the pipe-rack and jetty access road causing loss of the woodland habitat combined with the effect on the setting of the asset from a historic environment perspective. The duration of these effects will be permanent in nature, as the construction of the pipe-rack and jetty access road will cause permanent loss of the woodland. The impacts on this receptor of low value will be localised, therefore the overall in-combination effect on this receptor is assessed to be **moderate adverse** (significant). An Outline Woodland Compensation Strategy has been prepared and is appended at **Appendix 8.I [TR030008/APP/6.4]**. The Strategy sets out the approach to off-site planting of trees in the Immingham area to ensure that the tree loss from the Long Strip is appropriately compensated, as well as enhancement of existing woodland. Despite the woodland compensation proposed, the overall in-combination effect on this receptor remains as **moderate adverse** (significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**	**Moderate adverse (significant)**
Marine Water and Sediment Quality	NA	**Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities:** Minor adverse **Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities**: Minor adverse **Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities:** Minor adverse **Changes to marine water quality from accidental spillages of leaks:** Minor adverse	Temporary	Local	Changes are predicted to be low in magnitude (when compared with existing natural (baseline) conditions, temporary (whilst construction activity is ongoing) and short-lived (only occurring during piling/dredging/disposal activities)**.** Therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Minor adverse (not significant)**
Physical Processes	NA	**Increased SSC and potential sedimentation over the extent of the disturbance plume as a result of the construction of the new piers (piling) and capital dredging works:** Low **Increased SSC and potential sedimentation as a result of the deposit of capital dredge material at a licensed offshore disposal site:** Low **Changes in seabed bathymetry and composition as a result of deposition of**	Temporary	Local	Changes are predicted to be low in magnitude (when compared with existing natural (baseline) conditions, temporary (whilst construction activity is ongoing) and short-lived (only occurring during piling/dredging/disposal activities. In relation to marine cultural heritage receptors, increases in sedimentation and burial (by finer-grained sediments for example) are regarded as beneficial effects for archaeological preservation. Impacts derived from shipwash and vessel propulsion have not been identified as affecting seabed and sub-seabed receptors.	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.	**Low/ negligible exposure to change** **(not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination Effect
		dredged/disposal material within the area of the respective plumes: Low **Construction vessel activity – impacts on local hydrodynamics and sediment transport arising from ship wash and vessel propulsion:** Low					

Table 25-7: Summary of In-combination effects (Operation)

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual in-combination effect
Residential properties on Chestnut Avenue, Waterworks Street and Spring Street (East of Immingham) Type of receptor: Residential Noise receptor: NSR3	High	**Noise (On-site Operational):** Minor adverse **Floodplain inundation from tidal flooding, alteration in tidal and fluvial overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of land raising in the West and East Sites:** Minor adverse	Permanent	Local	In-combination effects are assessed to occur residential properties along Chestnut Avenue, Waterworks Street and Spring Street as a result of operational noise (on-site operational noise) and increase in flood risk. The duration of these effects will be permanent in nature, and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **minor adverse (not-significant)**.	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(Not significant)**
Residential properties on Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk and Kendal Road (East of Immingham) Type of receptor: Residential Noise receptor: NSR4	High	**Noise (On-site operational):** Negligible **/**Minor adverse **Noise (Project Traffic):** Negligible **/**Minor adverse **Floodplain inundation from tidal flooding, alteration in tidal and fluvial overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of land raising in the West and East Sites:** Minor adverse	Permanent	Local	In-combination effects are assessed to occur residential properties along Somerton Road, Worsley Road, Dunster Walk, Ings Lane, Oakham Walk and Kendal Road as a result of operational noise (both on-site operational noise and as a result of project traffic) and increase in flood risk. The duration of these effects will be permanent in nature, and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **minor adverse (not-significant)**.	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(Not significant)**
Benthic habitats and species Type of receptor: Ecological	High	**Changes to benthic habitats and species as a result of seabed material during maintenance dredging:** minor adverse /insignificant **Non-native species transfer during vessel operations**: minor adverse /insignificant	Permanent	Local	Maintenance dredging (if required) has the potential to result in combined effects on subtidal habitats and species with respect to habitat change. Maintenance dredging is expected to be to be very limited (if required at all). As a result, any dredging that is required will only be undertaken very periodically (frequency will be dictated by operational requirements but is anticipated there could be several years or more between maintenance dredge campaigns if required at all). On this basis, given the expected frequency of dredging, a comparable macrofaunal community to pre dredge conditions would be expected to occur over much of the maintenance dredging area between maintenance dredging campaigns. Cumulative effects could also occur due to introduction and spread of non-native species during construction and operation.	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual in-combination effect
					However, biosecurity control measures will be implemented during both phases to minimise the risk. Following the impact assessment methodology, the probability of occurrence and of cumulative impact pathways interacting is considered to be high but the magnitude of change will be small at worst with the application of the proposed measures. The exposure to change is, therefore, assessed as low. Given the overall low to moderate sensitivity of benthic habitats and species with the mitigation measures in place, and their moderate to high importance (depending on the nature conservation value of individual habitats and species), the potential cumulative and in-combination effects are assessed as insignificant to minor adverse and not significant.		
Coastal waterbirds Type of receptor: Ecological	High	**Direct changes to foraging and roosting habitat as a result of the presence of infrastructure:** Minor adverse **Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats:** Minor adverse	Permanent	Local	There is the potential for in-combination effects related to potential noise and visual disturbance during operation. Operational disturbance responses are, however, expected to be relatively limited. On this basis, the potential cumulative and in-combination effects are assessed as **minor** adverse and not significant. There is also the potential for in-combination effects related to the changes in habitat as a result of the presence of infrastructure along with potential disturbance during operation. However, it is acknowledged that such effects are likely to be interrelated to some extent. Observations from the ornithology surveys in the area suggest that birds regularly feed in very close proximity to both the Eastern Jetty (approximately 1km from the Project) and the Immingham Oil Terminal approach jetty (approximately 500m from the Project) – which are both similar open piled structures - with species such as Redshank, Dunlin, Turnstone regularly recorded underneath jetties and Curlew, Shelduck and Black-tailed Godwit approaching them closely (<10-20m). However, a review of bird distribution data for Sector C (for the period 2018/19 to 2021/22) found that the densities of coastal waterbirds (including Black-tailed Godwit, Shelduck, Dunlin and Redshank) were typically either higher or broadly comparable on the foreshore near to the existing IOT jetty (<100-150m) compared to greater distances away (approximately 150m to 1km). There is therefore unlikely to be a change in the overall distribution of waterbirds more widely along the foreshore fronting Immingham in this area. Operational disturbance responses are expected to be relatively limited. Based on the information provided above, the probability of avoidance responses occurring due to both the presence of structures and operational disturbance stimuli is considered to be high. However, responses are expected to be limited to relatively a localised area around berthing infrastructure. Magnitude and consequently exposure to change is, therefore, likely to be small when considered cumulatively. Given the moderate sensitivity of some species and as importance is high because of the protection afforded to coastal waterbirds, the potential cumulative and in-	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual in-combination effect
					combination effects are assessed as minor adverse and not significant.		
Marine Water and Sediment Quality	High	**Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities:** Minor adverse **Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities**: Minor adverse **Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities:** Minor adverse **Changes to marine water quality from accidental spillages of leaks:** Minor adverse	Permanent	Local	Changes are predicted to be low in magnitude (when compared with existing natural (baseline) conditions and limited in extent to the Project footprint and a small area adjacent. Maintenance dredging is predicted to be very limited (if required at all), leading to a minor adverse (not significant) in-combination effect.	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(not significant)**
Physical Processes	NA	**Local changes to hydrodynamic regime (flow speed and direction) as a result of the piers (piling) and capital dredging:** Low **Local changes to the wave regime, as a result of the piers (piling) and capital dredging:** Low **Associated local changes to the sediment transport pathways, as a result of localised changes to the driving hydrodynamic (and wave) forcing:** Low **Potential impact on existing features, including marine infrastructure, outfalls and estuary banks and channels:** Low	Permanent	Local	Changes are predicted to be low in magnitude (when compared with existing natural (baseline) conditions and limited in extent to the Project footprint and a small area adjacent. Maintenance dredging is predicted to be very limited (if required at all), leading to a negligible impact.	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse/negligible exposure to change** **(not significant)**
North Beck Drain	High	**Potential operational pollution of surface watercourses from accidental spillages:** Negligible/minor adverse **Potential run off of hazardous firefighting chemicals to surface water course:** Negligible/minor adverse **Increase in risk of surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths:** Minor beneficial	Permanent	Local	In-combination effects are assessed to occur on the North Beck Drain as a result of the potential operational impacts and risks listed left. The duration of these effects will be permanent in nature, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant)	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse** **(not significant)**

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual in-combination effect
Habrough Marsh Drain	High	**Potential operational pollution of surface watercourses from accidental spillages:** Negligible/minor adverse **Potential run off of hazardous firefighting chemicals to surface water course:** Negligible/minor adverse **Increase in risk of surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths:** Minor beneficial **Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk:** Minor adverse	Permanent	Local	In-combination effects are assessed to occur on the Habrough Marsh Drain as a result of the potential operational impacts and risks listed left. The duration of these effects will be permanent in nature, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse (not significant)**
Local Drains	High	**Potential operational pollution of surface watercourses from accidental spillages:** Negligible/minor adverse **Potential run off of hazardous firefighting chemicals to surface water course:** Negligible/minor adverse **Increase in risk of surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths:** Minor beneficial	Permanent	Local	In-combination effects are assessed to occur on Local Drains as a result of the potential operational impacts and risks listed left. The duration of these effects will be permanent in nature, and the impacts will be localised, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant)	No additional mitigation measures are proposed beyond those committed to in the technical chapters **[TR030008/APP/6.2].**	**Minor adverse (not significant)**

Table 25-8: Summary of in-combination effects (decommissioning)

Receptor	Value	Potential In-combination impacts	Duration	Scale	Discussion	Mitigation	Residual In-combination effect
Residential properties on Chestnut Avenue, Waterworks Street and Spring Street (East of Immingham) Type of receptor: Residential Noise receptor: NSR3 Representative viewpoint: VP5 Representative traffic and transport receptor: Link 5	High	**Visual**: Minor adverse **Floodplain inundation from tidal flooding, alteration in tidal and fluvial overland flow paths, and potential increase in flood risk to the surrounding areas, as a result of land raising in the West and East Sites:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur residential properties along Chestnut Avenue, Waterworks Street and Spring Street as a result of construction dust, landside construction), visual effects resulting from the potential views of construction activity, traffic and transport, and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the decommissioning phase of the Project and the impacts will be localised, therefore the overall in-combination effect on these receptors is assessed to be **minor adverse (not significant)**.	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline DEMP [TR030008/APP/6.6]**.	**Minor adverse (not significant)**
North Beck Drain Type of receptor: watercourse	High	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse **Surface water contamination:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur on the North Beck Drain as a result of the potential decommissioning impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the decommissioning phase of the Project, and the impacts will be localized, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline DEMP [TR030008/APP/6.6]**.	**Minor adverse (not significant)**
Habrough Marsh Drain Type of receptor: watercourse	High	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur on the Habrough Marsh Drain as a result of the potential decommissioning impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the decommissioning phase of the Project, and the impacts will be localized, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline DEMP [TR030008/APP/6.6]**.	**Minor adverse (not significant)**

		Potential changes in tidal regime including wave erosion/accretion rates resulting in siltation of the Habrough Marsh Drain outfall, increasing fluvial flood risk: Minor adverse **Surface water contamination:** Minor adverse					
Local Drains Type of receptor: watercourse	Medium	**Direct spillage:** Negligible**/**Minor adverse **Runoff contamination:** Negligible**/**Minor adverse **Alteration in fluvial and overland flow paths, and potential increase in flood risk as a result of storing construction materials in the floodplain:** Negligible**/**Minor adverse **Increased risk of blockage of drains as a result of increased material transported from run-off from Site:** Negligible**/**Minor adverse **Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses:** Minor adverse	Temporary	Local	In-combination effects are assessed to occur on Local Drains as a result of the potential decommissioning impacts and risks listed left. The duration of these effects will be temporary in nature, occurring only during the decommissioning phase of the Project, and the impacts will be localized, therefore the overall in-combination effect on this receptor is assessed to be **minor adverse** (not significant).	No additional mitigation measures are proposed beyond those committed to in the technical chapters, including implementation of mitigation through the **Outline DEMP [TR030008/APP/6.6]**.	**Minor adverse (not significant)**

25.6 Cumulative Effects Assessment (Stages 1 - 3)

25.6.1 Cumulative effects are generally unlikely to arise unless other development sites are in close proximity to the Project. However, the nature of potential effect and the actual distance at which two developments cumulatively impact a receptor depends on the nature of the impact (e.g. cumulative air quality effects could occur for the Project at a greater distance than say noise and vibration effects).

Stage 1: Establishing the ZoI and Identifying a Long List of 'Other Development'

25.6.2 The initial screening exercise was repeated (Stage 1) since the Preliminary Environmental Information Report ("PEIR") to identify any further potential major and other developments and plans within the study area and the various tiered developments within the study area as detailed above to create the long list for consideration based on Appendix 1 Matrix 1 of the Inspectorate's Advice Note Seventeen (Ref 25-4). The long list of cumulative developments used for the CEA is presented in **Appendix 25.A [TR030008/APP/6.4]**.

Stage 2: Identify Shortlist of 'Other Development' for the CEA

25.6.3 The long list has subsequently been screened based on the potential for interactions with the Project across all the technical disciplines considered within this ES (**Chapters 6 – 24 [TR030008/APP/6.2]**). The result of this screening exercise, and those developments that have been progressed to Stage 2, as well as the justification for shortlisting developments from the long list, is provided in **Appendix 25.B [TR030008/APP/6.4]**. The short-listed schemes are also shown on **Figure 25.1 [TR030008/APP/6.3]**.

25.6.4 A total of 29 developments on the shortlist presented in Appendix 25.B have been taken forward into Stage 3 and 4 of the CEA. These proposed developments are considered to have some potential for overlap with the Project in line with the criteria set out in **Paragraph 25.4.31** and warrant a full assessment of cumulative effects to be undertaken. Of these developments it is considered that the IERRT (ID 22: TR030007) has the greatest potential to lead to significant cumulative effects in association with the Project due to its nature, scale and location – this development is therefore discussed in further detail within the CEA, presented in **Appendix 25.C [TR030008/APP/6.4]**.

Stage 3: Information Gathering

25.6.5 Following the initial information search on the shortlisted developments at Stage 2, a search for more detailed information within the public domain was carried out for the shortlisted developments. In line with Advice Note Seventeen (Ref 25-4), this included searching for and recording the following information where available:

a. Development design and location information;

b. Construction, operation and decommissioning information; and

c. Any accompanying environmental assessment information detailing baseline data and effects arising from other development.

25.6.6 Information available for each of the proposed developments carried forward for the CEA is described below:

Table 25-9 Available information for each shortlisted development

ID	Development Description	Documents included within the application
ID 1: DM/1145/19/FUL (includes variation of conditions application DM/0603/22/FUL)	Construction and operation of an energy park comprising photovoltaic (PV) solar panels together with battery storage	• Archaeological Report • Heritage Assessment • Ecology surveys • Flood Risk Assessment • Agricultural Land Quality Report • Construction Traffic Management Plan • Landscape and Visual Assessment
ID 3: DM/0105/18/FUL (includes variation of conditions application DM/0545/20/NMA)	Hybrid application seeking outline consent with access, landscaping and scale to be considered for the development of a 62ha Business Park comprising up to 120,176 m2	• Flood Risk Assessment • Ecology reports • Environmental Statement (Transport, Noise and Vibration, Air Quality, Cultural Heritage, Ecology and Nature Conservation, Ground Conditions and Contamination, Water Quality, Flood Risk and Drainage, Landscape and Visual, Land Use and Agriculture, Socio-economics)
ID 5: DM/0968/19/FUL	Variation of conditions 1 (Approved Plans) and 2 (Scheme of Landscaping) as granted in permission DC/101/98/IMM	• Flood Risk Assessment • Surface Water Management Plan • Ecology reports • Landscape Visual Impact Assessment • Transport Statement
ID 9: DM/0865/19/FUL	Erection of 20MW gas fuelled embedded energy generation compound – Site 4	• Transport Statement • Landscape and Visual Impact Assessment • Flood Risk Assessment • Ecology survey reports • Ecological Impact Assessment • Environmental Statement (Ecology, Air Quality, Noise)

ID	Development Description	Documents included within the application
ID 10: DM/0864/19/FUL	Erection of 20MW gas fuelled embedded energy generation compound - Site 3	• Air quality assessment • Ecological impact assessment • Environmental Statement (Ecology, Air Quality, Noise)
ID 13: DM/0628/18/FUL (includes variation of conditions DM/0274/20/FUL)	Partially demolish existing building and erect 20MWE waste to energy power generation facility, 65m stack and associated plant, machinery	• Flood Risk Assessment • Environmental Statement (Air Quality and Climate Change, Ecology and Natural Heritage, Human Health, Landscape and Visual, Ground Conditions, Noise and Vibration, Transportation, Flood Risk, Drainage and Water, Major Accidents and Disasters, Socio-Economic, Cultural Heritage). • Transport Assessment • Noise Impact Assessment
ID 16: DM/0862/19/FUL	Erection of 20MW gas fuelled embedded energy generation compound - Site 1	• Environmental Statement (Air Quality, Noise) • Flood Risk Assessment • Ecological impact assessment
ID 17: DM/0863/19/FUL	Erection of 20MW gas fuelled embedded energy generation compound - Site 2	• Air quality assessment • Environmental Statement (Ecology, Air Quality, Noise) • Flood Risk Assessment
ID 18: DM/0026/18/FUL	Erect an Energy Recovery Facility with an electricity export capacity of up to 49.5MW and associated infrastructure including a stack to 90m high	• Environmental Statement (Landscape and Visual, Ecology and Nature Conservation, Noise and Vibration, Air Quality and Human Health, Soils, Geology and Hydrology, Surface Water and Flood Risk, Socio-economics, Archaeology & Cultural Heritage) • Flood Risk Assessment • Transport Assessment
ID 21: EN010107 DCO Application	South Humber Bank Energy Centre	• Environmental Statement (Air Quality, Noise and Vibration, Traffic and Transport, Ecology, Landscape and Visual, Geology, Hydrology and Land Contamination, Cultural Heritage, Flood Risk, Hydrology and Water Resources, Socio-economics, Waste

ID	Development Description	Documents included within the application
		Management, Human Health, Sustainability and Climate Change)
ID 22: TR030007 DCO Application	Immingham Eastern Ro-Ro Terminal (IERRT)	• Environmental Statement Volume 1-3 (Physical Processes, Water and Sediment, Nature Conservation and Marine Ecology, Commercial and recreational Navigation, Coastal Protection, Flood Defence, and Drainage, Ground Conditions, Including Land Quality, Air Quality, Airborne Noise and Vibration, Cultural Heritage and Marine Archaeology, Socio-economics, Traffic and Transport, Land Use Planning, Climate Change)
ID 25: TR030001, TR030005 and TR030006 DCO Application	Able Marine Energy Park including Material Changes 1 and 2	• Environmental Statement (Geology, Hydrology and Ground Conditions, Hydrodynamic and sedimentary regime, Water Quality and Sediment Quality, Aquatic Ecology, Aquatic Ecology, Terrestrial Ecology and Birds, Commercial Fisheries, Drainage and Flood Risk,Commercial and Recreation Navigation, Traffic and Transport, Noise and Vibration, Air Quality, Marine and Terrestrial Archaeology, Light, Landscape and Visual, Socio-Economic, Aviation, Waste, Health)
ID 27: EN010038, DCO Application	North Killingholme Power Project	• Environmental Statement (Air Quality, Ecology and Biodiversity, Historic Environment, Landscape and Visual Impact, Noise and Vibration, Socio-economics, Traffic and Transport, Water Quality and Resources, Geology and Land Contamination, Public Health)
ID 28: EN070006 DCO Application	Humber Low Carbon Pipelines	• Scoping Report
ID 29: EN070008 DCO Application	Viking CCS Pipeline	• Scoping Report
ID 35: DM/0329/18/FUL	Erection of industrial building and adjoined two storey office/control room to create	• Environmental Statement (Noise, Traffic and Transport, Ornithology, Socio-Economic)

ID	Development Description	Documents included within the application
	power plant (18MW Energy From Waste)	• Flood Risk Assessment • Ecology Report • Archaeology and Cultural Heritage Report
ID 37: DM/1070/18/FUL	Construction of an energy from waste facility of up to 49.9MWe gross capacity including emissions stack(s) and associated infrastructure	• Environmental Statement (Air Quality, Noise and Vibration, Traffic and Transport, Ecology and Nature Conservation, Landscape and Visual, Geology, Hydrology and Land Contamination, Cultural Heritage, Flood Risk, Hydrology and Water Resources, Socio-economics, Waste Management)
ID 40: DM/0378/15/OUT	Outline planning application with means of access to be considered for the construction of up to 250 residential dwellings	• Ecology surveys • Flood Risk Assessment • Geophysical Report • Transport Assessment • Archaeological Evaluation Report • Arboriculture Impact Assessment
ID 41: DM/0728/18/OUT	Outline planning application for the development of up to 525 residential dwellings together with an extra care facility	• Flood Risk Assessment • Heritage Assessment • Noise Impact Assessment • Geo Environmental Assessment • Air Quality Assessment • Sustainability Statement • Archaeological Evaluation Report • Transport Assessment • Ecological Appraisal
ID 42: DM/1175/17/FUL	Residential development for 145 dwellings	• Transport Assessment • Flood Risk Assessment • Ecology Report
ID 87: DM/0422/17/FUL	Construction of a carbon regeneration plant, hydrothermal plant and associated works.	• Flood Risk Assessment

ID	Development Description	Documents included within the application
ID 94: MLA/2020/00520	Humber International Terminal berth 2: adaptation for car carriers	• N/A
ID 95: PA/2018/918	Planning permission to construct a new gas-fired power station with a gross electrical output of up to 49.9 megawatts. A further non-material amendment application has been made (PA/2021/1039	• Environmental Statement (Air Quality, Noise and Vibration, Landscape and Visual, Ecology, Cultural Heritage, Ground Conditions and Hydrology, Surface Water, Flood Risk and Drainage) • Transport Statement • Ecology surveys
ID 96: DM/0111/21/FUL	Installation of wash down facility to include new drainage, underground tanks, above ground tanks with 1 m high bunded wall enclosure, installation of 2.4 m high track and trace ANPR (automatic number plate recognition) system and siting of modular building for staff welfare at Immingham Lorry Park Pelham Road	• Flood Risk Assessment
ID 102: DM/1071/22/FUL	Rock revetment repair and reinforcement along a 4.5km section of the Humber Estuary, works to repair, reinstate and enable access to the gravity outfalls at Middle Drain, Oldfleet Drain and Mawmbridge Drain, associated landscape improvements, installation of temporary construction compounds and associated infrastructure	• Environmental Statement (Biodiversity – terrestrial, freshwater and marine, Water and Sediment Quality) • Ecology Surveys
ID 113 and 114: DM/0304/23/SCO and PA/SCO/2023/1	EIA Scoping request for Immingham onshore wind including up to three wind turbines	• Scoping Report
ID 115: MLA/2014/00431/4	Maintenance dredge disposal at Grimsby, Immingham and Sunk Dredged Channel	• N/A

ID	Development Description	Documents included within the application
ID 116: DM/0664/19/FUL	Velocys Waste to Fuel Plant, off Moody Lane	• Environmental Statement (Traffic and transport, noise, geo-environmental, heritage, social economic, landscape and visual, flood risk and drainage and air quality)
ID 117: PA/SCO/2022/7	Station Road South Killingholme, works on land to the east of Rosper Road, Killingholme	• Scoping Report

Stage 4: Cumulative Effects Assessment

25.6.7 The results of the Stage 4 CEA undertaken for the developments scoped in for further assessment are reported within **Appendix 25.C [TR030008/APP/6.4]** due to the scale of the assessment. A summary and conclusion of residual cumulative effects as a result of the CEA is presented in **Section 25.8**.

25.7 Limitations and difficulties

25.7.1 The assessment of potential in-combination effects uses information from the assessments contained within the relevant ES technical chapters (Chapters 6 - 24). This information is thus subject to the same limitations as associated with these individual assessments, as presented within their respective ES chapters **[TR030008/APP/6.2]**.

25.7.2 With regard to potential cumulative effects, the information included within this chapter is based upon information available at the time of the assessment regarding the environmental effects of the other planned or committed schemes that have been scoped into the assessment. Applicants for developments that are proposed after the DCO application for this Project is submitted will be responsible for considering the Project within the respective CEAs for their planned developments, as required.

25.8 Residual Effects and Conclusions

In-combination effects assessment

25.8.1 The assessment of in-combination effects has considered the potential for the effects of minor significance and above, identified within each of the technical assessments reported within **Chapters 6 to 24 [TR030008/APP6.2]**, to interact and combine to affect common receptors.

Construction

25.8.2 During the construction phase of the Project, the in-combination effects assessment has concluded that there would be a large adverse (significant) combined effect on '31 Queens Road and other residential properties along Queens Road, at the eastern end' and '1 Queens Road and other residential properties along Queens Road, at the western end' as a result of the combined effect of construction dust, noise (landside construction and construction traffic), vibration, visual effects, traffic and transport and increases in flood risk. The duration of these effects will be temporary in nature and the impacts will be localised. The in-combination effect reported on these residential receptors is no greater than the visual effect alone (major adverse), as reported in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]**. This effect in isolation has been mitigated as far as appropriate and therefore there are no additional mitigation measures proposed beyond those recommended in the technical chapters and **Outline CEMP [TR030008/APP/6.5].**

25.8.3 The in-combination effects assessment also concluded that there would be a large adverse (significant) combined effect during construction on commercial receptors along Queens Road as a result of visual effects and increases in flood risk. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised. The in-combination effect reported on these commercial receptors would be no greater than the visual effect alone (major adverse), as reported in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]**. This effect in isolation has been mitigated as far as appropriate and therefore there are no additional mitigation measures proposed beyond those recommended in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.

25.8.4 During the construction phase there would also be a large adverse (significant) in-combination effect on Bridleway 36 and the proposed England Coastal Path as a result of visual and socio-economic combined effects. The duration of these effects will be temporary in nature, occurring only during the construction phase of the Project and the impacts will be localised. As the residual in-combination effect is driven by the major adverse visual effect (as detailed in **Table 25-6**), the in-combination effect is no worse than the effect in isolation. This effect in isolation has been mitigated as far as appropriate and therefore there are no additional mitigation measures proposed beyond those recommended in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.

25.8.5 The in-combination effects assessment concluded that there would be a moderate adverse (significant) combined effect during operation on the 'Long Strip' woodland, as a result of the construction of the pipe-rack and jetty access road causing loss of the woodland habitat, combined with the effect on the setting of the asset from a historic environment perspective. The duration of these effects will be permanent in nature and will be localised. The in-combination effect reported on this receptor would be no greater than the ecological effect alone (moderate adverse), as reported in **Chapter 8: Nature**

Conservation (Terrestrial Ecology) [TR03008/APP/6.2], therefore no additional mitigation measures are proposed beyond those committed to in the technical chapter, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5]**.

Operation

25.8.6 No significant residual in-combination effects have been identified for the operational phase of the Project.

Decommissioning

25.8.7 No significant residual in-combination effects have been identified for the decommissioning phase of the Project.

Cumulative effects assessment

25.8.8 The assessment of cumulative effects has considered other developments within 10km of the Site boundary (identifying 117 developments for consideration at Stage 1 in the long list, and 29 for inclusion in the shortlist of developments and assessment at Stages 3 and 4); the potential for cumulative effects to arise, from one or several of these developments in combination with the Project has been assessed.

25.8.9 Through consideration of the available information for each of the identified developments, it has been concluded that during construction, there is the potential for:

a. Significant, **large beneficial** cumulative socio-economic effects due to the construction of the Project together with ten other developments (ID 13, ID18, ID22, ID25, ID29, ID35, ID37, ID 94, ID102, ID115), due to the increase in employment opportunities during the construction phase. The magnitude of effect is no greater than that reported within **Chapter 23: Socio-economics [TR030008/APP/6.2]** for the Project alone, however the major beneficial effect will be intensified by the construction of the 'other developments';

b. Significant, **moderate adverse** long-term cumulative landscape effects on the Site and its immediate setting due to construction of the Project together with ID5 and ID115 due to the cumulative developments introducing construction activity on land immediately to the south of the West Site and within the Humber Estuary to the north east. Due to the high number of existing large-scale industrial complexes and road corridors that influence the Site and its immediate setting, it is assessed that the introduction of construction activity alongside the Project would result in a limited change to the Site and its immediate setting. It is therefore assessed that the cumulative impact would remain at medium, the same for the Project assessed in isolation;

c. Significant, **large adverse** short-term cumulative visual effects on Viewpoint 2 as a result of the construction of the Project together with ID13, ID18 and ID115. The construction of the stacks associated with the cumulative developments would be visible in the distance, above the line of trees and dredging would be visible in the foreground. The presence of other characteristic, cumulative developments will very slightly intensify the built visible structures from this location. The addition of the construction activities associated with the Project will result in a high cumulative impact, although no greater than that assessed for the Project in isolation;

d. Significant, **large adverse** short-term cumulative visual effects on Viewpoint 3 as a result of the construction of the Project together with ID21, ID37, ID115 and ID116 as construction of the stacks associated with the cumulative developments would be visible in the distance, above the line of trees and dredging would be visible in the foreground. The presence of other characteristic, cumulative developments will very slightly intensify the built visible structures from this location. These effects are no greater than those concluded for the Project on its own; and

e. Significant, **large adverse** short-term cumulative visual effects on Viewpoint 11 as a result of the construction of the Project together with ID13, ID18 and ID116, due to the construction of the stacks associated with the other developments being visible in the middle and far distance from this point. The presence of other characteristic, cumulative developments will very slightly intensify the built visible structures from this location however this effect will be no greater than that assessed for the Project in isolation.

25.8.10 Through consideration of the available information for each of the identified developments, it has been concluded that during operation, there is the potential for:

a. Significant, **moderate adverse** cumulative visual effects on Viewpoint 2 as a result of the visibility of characteristic built structures slightly intensifying due to the operation of the Project cumulatively with three other developments (ID13, ID18 and ID115). These effects are no greater than those concluded for the Project on its own;

b. Significant, **moderate adverse** long-term cumulative visual effects on Viewpoint 3 as a result of the visibility of characteristic built structures slightly intensifying due to both the operation of the Project together with other developments (ID21, ID37, ID115 and ID116) due to the presence of the stacks associated with the identified cumulative developments slightly intensifying the visibility of characteristic built structures from this location. These effects are no greater than those concluded for the Project on its own; and

c. Significant, **moderate beneficial** cumulative socio-economic effects due to the operation of the Project together with other developments (ID22, and ID116) due to the increase in employment opportunities during the operational phase. The magnitude of this effect is no greater than that reported within **Chapter 23: Socio-economics [TR030008/APP/6.2]** for the

Project alone, however the major beneficial effect will be intensified by the operation of the 'other developments'.

25.8.11 There would be no significant cumulative effects relating to air quality, noise and vibration, nature conservation (terrestrial), nature conservation (marine ecology), ornithology, marine transport and navigation, historic environment (terrestrial and marine), physical processes, marine water quality, water use, water quality, coastal protection, flood risk and drainage, ground conditions and land quality and major accidents and disasters.

Table 25-10 Summary of significant In-combination effects

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
Construction	In-combination effect from construction dust, noise (landside construction and construction traffic), vibration, visual effects, traffic and transport and increases in flood risk to 31 Queens Road and other residential properties along Queens Road, at the eastern end.	**Large adverse (significant)**	No additional mitigation measures are proposed beyond those recommended in the technical chapters and **Outline CEMP [TR030008/APP/6.5].**	**Large adverse (significant)** The in-combination effect reported on these residential receptors is no greater than the visual effect alone (major adverse), as reported in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2]**.	Temporary and localised
Construction	In-combination effect from construction dust, noise (landside construction and construction traffic), vibration, visual effects, traffic and transport and increases in flood risk to 1 Queens Road and other residential properties along Queens	**Large adverse (significant)**	No additional mitigation measures are proposed beyond those recommended in the technical chapters and **Outline CEMP [TR030008/APP/6.5].**	**Large adverse (significant)** The in-combination effect reported on these residential receptors is no greater than the visual effect alone (major adverse), as reported in **Chapter 13: Landscape and**	Temporary and localised

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
	Road, at the western end.			**Visual Impact [TR030008/APP/6.2]**.	
Construction	In-combination effect from construction visual effects and increases in flood risk on commercial receptors along Queens Road.	Large adverse (significant)	No additional mitigation measures are proposed beyond those recommended in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5].**	Large adverse (significant) The in-combination effect reported on these commercial receptors would be no greater than the visual effect alone (major adverse), as reported in **Chapter 13: Landscape and Visual Impact [TR030008/APP/6.2].**	Temporary and localised
Construction	In-combination effect as a result of visual and socio-economic combined effects on Bridleway 36 and the proposed England Coastal Path.	Large adverse (significant)	No additional mitigation measures are proposed beyond those recommended in the technical chapters, including implementation of mitigation through the **Outline CEMP [TR030008/APP/6.5].**	Large adverse (significant)	Temporary and localised

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
Construction	In-combination effect from the construction of the pipe-rack and jetty access road causing loss of the woodland habitat, combined with the effect on the setting of the asset from a historic environment perspective on the 'Long Strip' woodland.	**Moderate adverse (significant)**	No additional mitigation.	**Moderate adverse (significant)** The in-combination effect reported on this receptor would be no greater than the ecological effect alone (moderate adverse), as reported in **Chapter 8: Nature Conservation (Terrestrial Ecology) [TR030008/APP/6.2].**	Permanent and localised

Table 25-11 Summary of significant Cumulative effects

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
Construction	Cumulative socio-economic effect due to the construction of the Project together with ten other developments (ID 13, ID18, ID22, ID25, ID29, ID35, ID37, ID 94, ID102, ID115), due to the increase in employment opportunities during the construction phase.	**Large beneficial (Significant)**	No mitigation.	Large beneficial (Significant). The magnitude of effect is no greater than that reported within **Chapter 23: Socio-economics [TR030008/APP/6.2]** for the Project alone, however the major beneficial effect will be intensified by the construction of the 'other developments'.	Temporary
Construction	Cumulative landscape effects on the Site and its immediate setting due to construction of the Project together with ID5 and ID115 due to the cumulative developments introducing construction activity on land	**Moderate adverse (Significant)**	No mitigation.	**Moderate adverse (Significant)** Due to the high number of existing large-scale industrial complexes and road corridors that influence the Site and its immediate setting, it is assessed that the	Long term

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
	immediately to the south of the West site and within the Humber Estuary to the north east.			introduction of construction activity alongside the Project would result in a limited change to the Site and its immediate setting. It is therefore assessed that the cumulative impact would remain at medium, the same for the Project assessed in isolation.	
Construction	Cumulative visual effects on Viewpoint 2 as a result of the construction of the Project together with ID13, ID18 and ID115. The construction of the stacks associated with the cumulative developments would be visible in the distance, above the line of trees	Large adverse (Significant)	No mitigation.	Large adverse (Significant) The presence of other characteristic, cumulative developments will very slightly intensify the built visible structures from this location. The addition of the construction activities associated with the Project will	Short term

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
	and dredging would be visible in the foreground.			result in a high cumulative impact, although no greater than that assessed for the Project in isolation.	
Construction	Cumulative visual effects on Viewpoint 3 as a result of the construction of the Project together with ID21, ID37, ID115 and ID116 as construction of the stacks associated with the cumulative developments would be visible in the distance, above the line of trees and dredging would be visible in the foreground.	Large adverse (Significant)	No mitigation	Large adverse (Significant) The presence of other characteristic, cumulative developments will very slightly intensify the built visible structures from this location. These effects are no greater than those concluded for the Project on its own.	Short term
Construction	Cumulative visual effects on Viewpoint 11 as a result of the construction of the Project together with	Large adverse (Significant)	No mitigation	Large adverse (Significant) The presence of other characteristic, cumulative	Short term

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
	ID13, ID18 and ID116, due to the construction of the stacks associated with the other developments being visible in the middle and far distance from this point.			developments will very slightly intensify the built visible structures from this location however this impact will be no higher than that assessed for the Project in isolation.	
Operation	Cumulative visual effects will occur on Viewpoint 2 as a result of the visibility of characteristic built structures slightly intensifying due to the operation of the Project cumulatively with three other developments (ID13, ID18 and ID115).	**Moderate adverse (significant)**	No mitigation	**Moderate adverse (significant)** These effects are no greater than those concluded for the Project on its own.	Long term
Operation	Cumulative visual effects on Viewpoint 3 as a result of the visibility of characteristic built structures slightly intensifying due to both	**Moderate adverse (significant)**	No mitigation	**Moderate adverse (significant)** These effects are no greater than those	Long term

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
	the operation of the Project together with other developments (ID21, ID37, ID115 and ID116) due to the presence of the stacks associated with the identified cumulative developments slightly intensifying the visibility of characteristic built structures from this location.			concluded for the Project on its own.	
Operation	Cumulative socio-economic effects due to the operation of the Project together with other developments (ID22, and ID116) due to the increase in employment opportunities during the operational phase.	**Moderate beneficial (significant)**	No mitigation	**Moderate beneficial (significant)** The magnitude of this effect is no greater than that reported within **Chapter 23: Socio-economics [TR030008/APP/6.2]** for the Project alone, however the major beneficial effect will be intensified by the	Long term

Development Stage	Environmental effect (following development design and impact avoidance measures)	Classification of effect prior to mitigation	Mitigation/ enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Long term (Lt)/ Medium term (Mt)/ Short term (St) and Permeant (P)/ Temporary (T)
				operation of the 'other developments'.	

25.9 References

Ref 25-1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Ref 25-2 Department for Transport (2012). The National Planning Policy Statement for Ports.

Ref 25-3 European Commission (2014). Directive 2014/ 52/ EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/ 92/ EU on the assessment of the effects of certain public and private projects on the environment.

Ref 25-4 The Planning Inspectorate (2019). Advice Note Seventeen. Cumulative Effects Assessment (Version 2).

Ref 25-5 UK Marine Policy Statement (2011).

Ref 25-6 Marine Management Organisation (2016). East Inshore and East Offshore Marine Plans.

Ref 25-7 The Town and Country Planning (Development Management Procedure) (England) Order 2015.

Immingham Green Energy Terminal

TR030008

Volume 6

6.2 Environmental Statement

Chapter 26: Summary of Likely Significant Effects

Planning Act 2008

Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

September 2023

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)

Immingham Green Energy Terminal

Development Consent Order 2023

6.2 Environmental Statement

Chapter 26: Summary of Likely Significant Effects

Regulation Reference	APFP Regulation 5(2)(a)
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Application Document Reference	TR030008/APP/6.2
Author	Associated British Ports Air Products BR

Version	Date	Status of Version
Revision 1	21 September 2023	DCO Application

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Tables

26 Summary of Likely Significant Effects

26.1 Introduction

26.1.1 **Chapters 6 to 25** of this Environmental Statement ("ES") **[TR030008/APP/6.2]** have considered the potential environmental impacts and effects of the Project. This chapter provides a summary of those adverse and beneficial environmental effects that are considered to be likely significant effects (i.e. moderate and major effects).

26.2 Significant Environmental Effects and Proposed Mitigation Measures

26.2.1 **Table 26-1** summarises the likely significant environmental effects of the Project that have been identified by the preliminary assessment, following the implementation of embedded mitigation and/or impact avoidance measures included in the design of the Project (as detailed in **Chapters 6 to 25 [TR030008/APP/6.2]** where relevant). **Table 26-1** also summarises any additional mitigation measures that have been identified in the technical assessments contained in the ES.

26.2.2 For each topic, the reasonable worst-case scenario has been assessed, including the construction programme scenario and design parameters. Further details on the reasonable worst case (or 'the Rochdale Envelope') are set out in **Chapter 5: EIA Process [TR030008/APP/6.2]**. The specific worst-case for each assessment is described in **Chapters 6 to 25 [TR030008/APP/6.2]** as appropriate. Effects have been assessed for the Project construction, operation (including maintenance) and decommissioning scenarios (where the assessment has included the decommissioning phase of the Project).

26.2.3 The ongoing work on the detailed design of the Project may further reduce likely significant adverse environmental effects.

26.2.4 As outlined in **Chapter 5: EIA Process [TR030008/APP/6.2]**, for the purposes of this Environmental Impact Assessment ("EIA"), an effect is considered to be 'significant' if it is assessed to be moderate (adverse or beneficial) or major (adverse or beneficial). Minor and negligible effects are only referenced in this chapter where a 'significant' (moderate or major) effect has been reduced to a 'not significant' effect following additional mitigation. Some technical chapters deviate from the generic methodology outlined in **Chapter 5: EIA Process [TR030008/APP/6.2]** and follow more specific methodology applicable to their respective assessments, or use different terminology to describe the magnitude of effect identified, for example **Chapter 25: Cumulative and In-combination Effects [TR030008/APP/6.2]**. Where this is the case, this is outlined in the methodology section of each technical chapter of this ES **[TR030008/APP/6.2]**.

26.2.5 To provide further clarification on the nature of the effects, each effect has been identified for the purposes of this summary as:

a. Short term ("St") – effects occurring only over a short period of time e.g. An effect that only lasts for the duration of the construction period, or one that lasts for only part of the operational phase.

b. Medium term ("Mt") – effects occurring for the duration of the Project's operation, but which cease when operations cease.

c. Long term ("Lt") – effects occurring beyond the operation of the Project, for example the permanent loss of a habitat due to the Project.

d. Temporary ("T") – effects that are not permanent because the effect would no longer occur if the impact was removed within the relevant timescale (for example the visual amenity impact of construction structures would be described as St, T as the impact goes when the structures are removed).

e. Permanent ("P") – effects that are permanent and cannot be readily reversed within the relevant timescale (for example an environmental feature that is lost and cannot be replaced until after decommissioning would be Mt, P. In the event that it could not be replaced at all, this would be Lt, P).

f. Direct ("D") – effects that result from a direct impact, for example, the loss of an ecological habitat.

g. Indirect ("In") – also known as secondary effects, effects that result indirectly, for example, increased traffic could indirectly impact on air quality.

Table 26-1: Summary of Likely Significant Residual Effects

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Chapter 6: Air Quality					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				
Chapter 7: Noise and Vibration					
Construction	Construction noise from landside works for residential Noise Sensitive Receptors ("NSRs") on Queens Road (NSR 1 and NSR 2)	Potentially up to **moderate adverse (significant)** (daytime) Potentially up to **major adverse (significant)** (Saturday afternoons)	Additional specific measures where possible (use of noise-control equipment such as jackets on pneumatic drills, acoustic covers on compressors, shrouds on piling rigs and cranes), temporary acoustic barriers and screens.	**Minor adverse (not significant)**	St/T/D
Construction	Construction noise from landside works for residential NSRs on eastern edge of Immingham (NSR 3 and NSR 4)	Potentially up to **moderate adverse (significant)** (Saturday afternoons)	Standard impact avoidance construction noise and vibration mitigation measures. Additional specific measures where possible during site clearance works on Saturday afternoon e.g. use of noise-control equipment such as	**Negligible-Minor adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
			jackets on pneumatic drills, acoustic covers on compressors, shrouds on and cranes, temporary acoustic barriers and screens.		
Operation	On-site plant noise and operations on residential NSRs on eastern edge of Immingham	Up to **moderate/major adverse (significant)** (daytime) and up **to major adverse (significant)** (night-time)	Limits on noise emissions from plant and equipment at source. Acoustic barriers/screens or earth bunds to reduce transmission of noise from the Site to NSRs.	**Minor adverse (not significant)**	Mt/P/D
Decommissioning	Decommissioning effects are expected to be as per construction phase effects.				
Chapter 8: Terrestrial Ecology					
Construction	Pipe-rack and jetty access road construction resulting in loss of/ damage to mature deciduous woodland habitat	**Moderate adverse (significant**)	Woodland Compensation Strategy	**Moderate adverse (significant)**	Lt/P/D
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Chapter 9: Marine Ecology					
Construction	Fish - underwater noise disturbance and vibration during marine piling, capital dredging and dredge disposal	**Minor (not significant)** to **moderate adverse (significant)** (migratory fish during marine piling)	Apply soft start procedures during piling. Use vibro piling where possible. Seasonal piling restrictions. Night time working restriction.	**Insignificant adverse**	St/T/D
Construction	Marine mammals - underwater noise disturbance and vibration during piling, capital dredging and dredge disposal	**Minor (not significant)** to **moderate adverse (significant)** (marine piling)	Apply soft start procedures during piling. Use vibro marine piling where possible. Marine Mammal Observer will follow JNCC protocol to minimise the risk of injury to marine mammals during percussive marine piling	**Minor adverse (not significant)**	St/T/D
Operation	No significant effects are predicted to occur.				
Decommissioning	Decommissioning not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Chapter 10: Ornithology					
Construction	Airborne noise and visual disturbance to coastal waterbirds using intertidal habitats	**Minor (not significant)** to **moderate adverse (significant)**	Winter marine construction restriction on approach jetty for works within 200m of exposed foreshore (1 October to 31 March) Noise suppression system for marine piling Acoustic barrier/visual screen on approach jetty from 1 October to 31 March Apply soft start procedures during marine piling Cold weather construction restriction (all construction activity)	**Minor adverse (not significant)**	St/T/In
Construction	Permanent loss of woodland habitat within Long Strip affecting breeding birds (non-SPA/ Ramsar)	**Moderate adverse (significant)**	Compensation for loss of woodland to be agreed; like-for-like replacement would take longer to establish than the lifetime of this Project (which is anticipated to be 25 years for the operation of the terrestrial elements of the Project).	**Moderate adverse (significant)**	
Operation	No significant effects are predicted to occur.				

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Decommissioning	Decommissioning not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				
Chapter 11: Traffic and Transport					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	Decommissioning not included within the scope of assessment as significant traffic and transportation effects are unlikely.				
Chapter 12: Marine Transport					
Construction	All risk events identified during the construction phase of the Project have been reduced to As Low As Reasonably Practicable ("ALARP").				
Operation	All risk events identified during the operational phase of the Project have been reduced to ALARP.				
Decommissioning	Decommissioning not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				
Chapter 13: Landscape and Visual					
Construction	Impact on landscape character to the Site and its immediate setting	**Moderate adverse (significant)**	None	**Moderate adverse (significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Construction	Impact on recreational users at viewpoint 2 Public Rights of Way ("PRoW") and proposed England Coast Path Route	**Major adverse (significant)**	None	**Major adverse (significant)**	St/T/D
Construction	Impact on recreational users at viewpoint 3 bridleway/PRoW and proposed England Coast Path Route	**Major adverse (significant)**	None	**Major adverse (significant)**	St/T/D
Construction	Impact on residential receptors located on Queens Road at viewpoint 11	**Major adverse (significant)**	None	**Major adverse (significant)**	St/T/D
Operation	Impact on recreational users at viewpoint 2 PRoW and proposed England Coast Path Route	**Moderate adverse (significant)**	None	**Moderate adverse (significant)**	Lt/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Operation	Impact on recreational users at viewpoint 3 bridleway/PRoW and proposed England Coast Path Route	**Moderate adverse (significant)**	None	**Moderate adverse (significant)**	Lt/T/D
Decommissioning	It is considered that the effects identified associated with Project construction are also applicable to the Project decommissioning phase for the landside infrastructure associated with the Project.				
Chapter 14: Historic Environment Terrestrial					
Construction	Long Strip (MNL 1797) – Partial or complete, permanent truncation/ removal of below ground remains.	**Moderate adverse (significant)**	The work already being undertaken by the ecological/environmental teams will also act as a mitigation measure for the impact upon the historical nature of the woodland. Accordingly, no additional work is required in relation to this impact.	**Minor adverse (not significant)**	Lt/P/D
Construction	Peat deposits and organic alluvial deposits identified by Geoarchaeological evaluation - partial or complete, permanent truncation/removal of	**Major adverse (significant)**	Further analysis of the peat and organic alluvium samples obtained by the evaluation and report produced detailing the results of this work. Such work will provide useful information that would otherwise never been gained.	**Minor adverse (not significant)**	Lt/P/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	below ground remains within the West Site				
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				
Chapter 15: Historic Environment Marine					
Construction	Direct impacts on known and potential marine cultural heritage receptors and deposits of archaeological importance as a result of construction and capital dredging	**Major adverse (significant)**	Geophysical and geoarchaeological assessment of project survey data. Then, avoidance of known and potential receptors, implementation of archaeological exclusion zones ("AEZs") where deemed appropriate and reduction via a protocol for archaeological discoveries ("PAD") and specific measures agreed within a WSI for A2 anomalies within the construction footprint.	**Negligible positive (not significant)** (as long as geotechnical data are retained, analysed and reported on by qualified geoarchaeologist)	Lt/P/D
Operation	No significant effects are predicted to occur.				
Decommissioning	Decommissioning not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Chapter 16: Physical Processes					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	Decommissioning is not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				
Chapter 17: Marine Water and Sediment Quality					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	Decommissioning is not included within the scope of assessment as the marine infrastructure would, once constructed, become part of the fabric of the Immingham port estate.				
Chapter 18: Water Quality					
Construction	Direct spillage into North Beck Habrough Marsh Drain and local drains: Contamination from suspended solids or other chemical contaminants that may find their way into site	**Moderate/Major adverse (significant)**	Bunded operations and spill kits to be used on Site (to be specified in the **Outline Construction Environmental Management Plan ("CEMP") [TR030008/APP/6.5]**.	**Negligible/Minor adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	runoff, infiltrate to ground, or be spilt directly into waterbodies when there are works within or adjacent to them.				
Construction	Runoff contamination into North Beck, Habrough Marsh drain and local drains: the effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).	**Minor/Moderate adverse (significant)**	Bunded operations for all chemicals and fuels needed on Site (to be specified in the CEMP)	**Negligible/Minor adverse (not significant)**	St/T/D
Construction	Alteration in fluvial and overland flow paths, and potential increase in flood risk, as a result of storing construction materials in the floodplain – for North Beck, Habrough Marsh drain and local drains	**Minor/Moderate adverse (significant)**	Areas for storage of construction materials to be carefully considered (to be specified in the CEMP)	**Negligible/Minor adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Construction	Increased risk of blockage of drains as a result of increased material (sands, gravels etc.) transported in runoff from Site - North Beck, Habrough Marsh drain and local drains	Minor/Moderate adverse	Surface water runoff to be managed on site (to be specified in the CEMP)	**Negligible/Minor adverse (not significant)**	St/T/D
Construction	Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to compaction of soil, increases in impermeable area, disruption/alteration of existing surface water flow paths, works/structures within watercourses – for North Beck Drain, Habrough Marsh Drain, Imminhgam Pump Drain and Local land drainage ditches	Moderate adverse	Temporary drainage facilities (swales etc) provided during the construction phase to control discharge of surface water run-off.	**Minor Adverse (not significant)** for North Beck Drain, Habrough Marsh Drain and Imminhgam Pump Drain **Negligible (not significant)** for Local land drainage ditches	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Construction	Human Health (Construction workers and operatives) - exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	**Large adverse (significant)**	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site will be registered with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather. No work onsite during a flood warning period.	**Minor Adverse (not significant)**	St/T/D
Construction	Human Health (Site Visitors) -exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences	**Very large adverse (significant)**	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site will be registered with the Environment Agency Flood Warnings Direct Service. No visitors or access during periods of inclement weather. No work onsite during a flood warning period.	**Minor Adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Operation	Impacts upon North Beck, Habrough Marsh Drain and local drains – potential operational pollution of surface watercourses from accidental spillages.	**Minor/Moderate adverse (significant)**	Containment areas and bunded operations and spill kits to be used on Site.	**Negligible/Minor adverse (not significant)**	St/T/D
Operation	Impacts upon North Beck Drain, Habrough Marsh Drain and local drains – potential run off of hazardous firefighting chemicals to surface water course	**Major adverse (significant)**	Containment areas and bunded operational area with spill kits to be used and treatment/removal of liquids	**Negligible/Minor adverse (not significant)**	St/T/D
Operation	Increase in risk of fluvial/surface water flooding due to changes in surface water runoff rates/volumes due to increases in impermeable area, disruption/alteration of existing surface water flow paths – for North Beck Drain, Habrough Marsh Drain,	**Moderate adverse (significant)**	Site/surrounding area registered with the Environment Agency Flood Warnings Direct Service. Provision of a drainage strategy to manage surface water run-off up to and including the 1% AEP plus 40% climate change allowance. Surface water is stored and retained within the Site. Provision of a drainage strategy to manage surface water run-off up to	**Minor beneficial (not significant)**	Mt/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	Immingham Pump Drain and Local land drainage ditches		and including the 1% AEP plus 40% climate change allowance. Surface water is stored and retained within the Project boundary.		
Operation	Human Health (Site operatives and future workforce) – exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences.	**Large adverse (significant)**	Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site registered with the Environment Agency Flood Warnings Direct Service. No work or visitors onsite during a flood warning period.	**Minor adverse (not significant)**	Mt/T/D
Operation	Human Health (Site Visitors)	**Very large adverse (significant)**	Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. Site registered with the Environment Agency Flood Warnings Direct Service. No work or visitors onsite during a flood warning period.	**Minor adverse (not significant)**	Mt/T/D
Decommissioning	Direct spillage into North Beck, Habrough Marsh drain and local drains: Contamination	**Moderate/Major adverse (significant)**	Bunded operations and spill kits to be used on site (to be specified in the Decommissioning Environmental Management Plan ("DEMP")).	**Negligible/Minor adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	from suspended solids or other chemical contaminants that may find their way into site runoff, infiltrate to ground, or be spilt directly into waterbodies when there are works within or adjacent to them.				
Decommissioning	Runoff contamination of North Beck, Habrough Marsh drain and local drains: the effects of diffuse urban pollutants in surface water runoff (that may contain metals, hydrocarbons, and inert solids etc.).	**Minor/Moderate adverse (significant)**	Bunded operations for all chemicals and fuels needed on Site (to be specified in the DEMP).	**Negligible/Minor adverse (not significant)**	St/T/D
Decommissioning	Increase in risk of fluvial/surface water flooding due disruption/alteration of existing surface water flow paths, works/structures within	**Moderate adverse (significant)**	Overland flow paths maintained and surface water drainage system to remain in-situ.	**Minor adverse (not significant)** (for North Beck Drain, Habrough Marsh Drain and Immingham Pump Drain)	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	watercourses – for North Beck Drain, Habrough Marsh Drain, Immingham Pump Drain and Local land drainage ditches.			**Negligible adverse (not significant)** (for Local land drainage ditches)	
Decommissioning	Human health (construction workers and operatives) - exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences.	**Large adverse (significant)**	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. No visitors or access during periods of inclement weather Site will be registered with the Environment Agency Flood Warnings Direct Service. No work onsite during a flood warning period	**Minor adverse (not significant)**	St/T/D
Decommissioning	Human health (site visitors) - exposure to floodwater via flooding from predominantly tidal sources e.g. overtopping, such as surge events or breach of defences.	**Very large adverse (significant)**	Construction works would be carried out in accordance with the CEMP, including the Flood Response Plan. Site induction, including evacuation routes, safe refuge, access, and egress. No visitors or access during periods of inclement weather Site will be registered with the Environment Agency Flood Warnings Direct	**Minor adverse (not significant)**	St/T/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
			Service. No work onsite during a flood warning period		
Chapter 19: Climate Change					
Construction	No significant effects are predicted to occur.				
Operation	Impact resulting from operational greenhouse gas emissions	**Significant beneficial**	None required.	**Significant beneficial**	Lt/P/D
Operation	Increased frequency and severity of extreme weather potentially causing damage to structures and infrastructure.	**Significant adverse**	All new structures to either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity would be built into the designs.	**Not Significant**	Lt/P/D
Operation	Sea level rise potentially causing damage to structures and infrastructure.	**Significant adverse**	All new structures would either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity would be built into the designs. Additional design measures to cope with flood/high water level conditions on Site would be implemented (see	**Not Significant**	Lt/P/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
			Section 19.6 of **Chapter 19: Climate Change [TR30008/APP/6.2]**.		
Operation	Increased frequency and severity of extreme weather events (e.g. flooding, snow and ice, storms) causing potential damage to land-based infrastructure and disruption to power and water services which may impact the operation of the Project.	**Significant adverse**	All new assets and buildings would either be designed for the climatic conditions using appropriate design guidance where available, or adaptive capacity would be built into the designs. Storm-proof infrastructure would be incorporated where possible (e.g. underground power supplies). Addition of wind protection defenses (e.g. storm pin and tie-down procedures, crane buffers) across the Site. Specific measures to ensure safe storage of larger infrastructure (e.g. quay cranes). Regular maintenance of assets to be undertaken to detect deterioration and damage.	**Not Significant**	Lt/P/D
Operation	Increased temperatures causing a risk of destabilising chemicals /substances stored on site during operation.	**Significant adverse**	Storage and transfer of chemicals/ substances in line with safety regulations.	**Not significant**	Lt/P/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Decommissioning	Decommissioning not included within the scope of assessment for marine infrastructure as the development would, once constructed, become part of the fabric of the Immingham port estate. While it is likely that some Greenhouse Gas ("GHG") emissions would arise as part of the decommissioning of the landside hydrogen production facilities process, it is not possible to say with any certainty what they are likely to be due to the timeframe involved. Methods of deconstruction and disposal are not known at this time. It should also be noted that by the time the hydrogen production facilities are decommissioned, the UK has committed to achieving net zero emissions and therefore any impacts are unlikely to be significant.				
Chapter 20: Materials and Waste					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				
Chapter 21: Ground Conditions and Land Quality					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				
Chapter 22: Major Accidents and Disasters					
Construction	All risk events identified during the construction phase of the Project have been reduced to ALARP.				

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Operation	All risk events identified during the operational phase of the Project have been reduced to ALARP.				
Decommissioning	All risk events identified during the decommissioning phase of the Project have been reduced to ALARP.				
Chapter 23: Socio-economics					
Construction	North East Lincolnshire's economy: employment generation during the construction phase	Temporary **major beneficial (significant)**	None required.	**Major beneficial (Significant)**	St/T/D
Construction	North East Lincolnshire's economy: Gross Value Added ("GVA") generation during the construction phase	Temporary **moderate beneficial (significant)**	None required.	**Moderate beneficial (significant)**	St/T/D
Construction	Loss of residential properties on Queens Road	Permanent **moderate adverse (significant)**	None required.	**Moderate adverse (significant)**	Lt/P/D

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Operation	North East Lincolnshire's economy: employment generation during the operational phase	Permanent **moderate beneficial (significant)**	None proposed.	**Moderate beneficial (significant)**	Mt/T/D
Decommissioning	No significant effects are predicted to occur.				
Chapter 24: Human Health and Wellbeing					
Construction	No significant effects are predicted to occur.				
Operation	No significant effects are predicted to occur.				
Decommissioning	No significant effects are predicted to occur.				
Chapter 25: Cumulative and In-Combination Effects					
Construction	31 Queens Road and other residential properties along Queens Road, at the eastern end: in-combination effect as a result of construction dust, noise (landside construction and construction traffic),	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (Significant)**	St/T/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	vibration, visual effects, traffic and transport and increases in flood risk				
Construction	1 Queens Road and other residential properties along Queens Road, at the western end: in-combination effect as a result of construction dust, noise (landside construction and construction traffic), vibration, visual effects, traffic and transport and increases in flood risk	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (Significant)**	St/T/In
Construction	Commercial receptors along Queens Road: in-combination effect as a result of visual effects increases in flood risk.	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (Significant)**	St/T
Construction	Bridleway 36 and the proposed England Coastal Path: in-combination effect as a	Large adverse (Significant)	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	Large adverse (Significant)	ST/T/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	result of visual and socio-economic effects.				
Construction	'Long Strip' Woodland: in-combination effect as a result of the loss of woodland habitat, combined with the effect on the setting of the asset from a historic environment perspective.	**Moderate adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Moderate adverse (Significant)**	Lt/P/D
Construction	Cumulative socio-economic effects due to construction of the Project along with ten other developments (ID13, ID18, ID22, ID25, ID29, ID35, ID37, ID94, ID102 andID115) due to increases in employment opportunities during the construction phases.	**Large beneficial (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large beneficial (Significant)**	St/T/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Construction	Cumulative landscape effects on the Site and its immediate setting due to construction of the Project together with ID5 and ID 115.	**Moderate adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Moderate adverse (Significant)**	St/T/In
Construction	Cumulative visual effects on Viewpoint 2 as a result of construction of the Project together with ID13, ID18 and ID115.	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (significant)**	ST/T/In
Construction	Cumulative visual effects on Viewpoint 3 as a result of the construction of the Project and ID21, ID37, ID115 and ID116	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (Significant)**	ST/T/In
Construction	Cumulative visual effects on viewpoint 11 as a result of construction of the Project and ID13, ID18 and ID116.	**Large adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Large adverse (Significant)**	ST/T/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
Operation	Cumulative socio-economic effects due to operation of the Project along with other developments (ID22 and ID116) due to increases in employment opportunities during the operational phases.	**Moderate beneficial (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Moderate beneficial (Significant)**	Lt/P/In
Operation	Cumulative visual effects will occur on Viewpoint 2 as a result of the visibility of characteristic built structures slightly intensifying due to the operation of the Project cumulatively with three other developments (ID13, ID18 and ID115).	**Moderate adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Moderate adverse (Significant)**	Lt/P/In
Operation	Cumulative visual effects on Viewpoint 3 as a result of the visibility of characteristic built	**Moderate adverse (Significant)**	No worse effect than the effects in isolation, therefore no additional mitigation is proposed.	**Moderate adverse (Significant)**	Lt/P/In

Project stage	Environmental effect (following development design and impact avoidance measures (Embedded Mitigation)	Classification of effect prior to mitigation	Additional Mitigation/enhancement (if identified)	Classification of residual effect after mitigation	Nature of effect(s) (Lt/Mt/St and P/T and D/In)
	structures slightly intensifying due to both the operation of the Project together with other developments (ID21, ID37, ID115 and ID116) due to the presence of the stacks associated with the identified cumulative developments slightly intensifying the visibility of characteristic built structures from this location.				