Humber 2100+

Sustainability Appraisal: Final Scoping Report

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February 2020

Environment Agency

Project Delivery Partners

Jacobs ARUP HR Wallingford *Working with water*

Humber 2100+

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Foreword

We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks of people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

February 2020 Version Comment

This is the post-consultation version of the SA Scoping Report from 2018. This version is being made available to the general public with a small number of updates, including a project name change. It should be noted that the baseline data and legislation, policies and plans review used in this Scoping Report are from 2018, when the report was originally produced. These have not been updated for this February 2020 issue. However, they will be updated again for the main SA Report (see report stages in Section 2.3).

Similarly, due to the long project time period, the SA baseline and methodology may be adapted slightly in the main SA Report to take account of emerging legislation, policy and guidance. The SA will also work alongside the strategy's newly commissioned Natural Capital Study and the current work to embed the United Nations Sustainable Development Goals (UNSDGs) into Humber 2100+.

The project name changed from the Humber Strategy Comprehensive Review (referred to as 'The Review'), to Humber 2100+, to help emphasise that the project is not developing an updated version of the 2008 strategy, but is developing a new strategy.

The latest information on Humber 2100+ is available on the project website: https://consult.environment-agency.gov.uk/humber/strategyreview/

1. Introduction

1.1 Purpose of this report

A comprehensive review of the Humber Flood Risk Management Strategy, published in 2008 (Environment Agency, 2008), is being undertaken with the aim of developing a new, revised Strategy (Humber 2100+) that sets out the strategic approach to managing tidal flood risk around the Humber Estuary for the next 100 years that will be adopted by key organisations around the estuary.

A Sustainability Appraisal (SA) is being completed for Humber 2100+. The SA will incorporate a Strategic Environmental Assessment (SEA). It will assess the sustainability of the strategic proposals being considered in the new Strategy in terms of key environmental, social and economic factors.

The purpose of this SA Scoping Report is to record the findings of the SA scoping stage, with the following aims:

- to set out baseline information for the study area across economic, social and environmental themes;
- to record the review of legislation, plans and policies that are most relevant to flood risk management proposals in the study area;
- to develop a 'SA Framework' comprising a set of sustainability objectives that the Strategy will look to achieve and a set of criteria against which the proposed options will be appraised; and
- to elicit feedback from key stakeholders on the scoping stage baseline information and proposed framework of objectives, to inform the appraisal of strategic flood risk management options.

1.2 Background to the Strategy

The existing Humber Flood Risk Management Strategy[1] was approved by Defra in 2007, published in 2008 and began to be implemented in 2009. It sets out a strategic approach for managing tidal flood risk around the Humber Estuary over 100 years. The existing Strategy examined different ways of managing flood risk around the Humber Estuary, raising defences where appropriate but considering the potential benefits of providing flood storage at three locations. It also identified sites where the defences could be realigned to provide compensatory habitat under the England and Wales Habitats Regulations. It aimed to ensure a good standard of protection from tidal flooding for the first 25 years and beyond for 99% of residents around the estuary and the important industrial areas.

There were, however, substantial lengths of frontage for which making defence improvements was uneconomic, and so the standard of protection would diminish as sea levels rise. The Strategy indicated that it would be reviewed at regular intervals. In addition, the changes introduced by the Flood and Water Management Act 2010 suggest an increased role for local authorities in flood risk management and introduced the partnership funding approach. The purpose of Humber 2100+ is to develop a revised Strategy (referred as 'the Strategy') for managing tidal flood risk around the estuary for the next 100 years, taking other sources of flooding into account and focusing on the first 25 years. It will also consider predicted sea level rise linked to climate change. Humber 2100+ is being undertaken by the Environment Agency in full partnership with the Lead Local Flood Authorities and Local Planning Authorities around the estuary, as well as other Statutory Agencies, Risk Management Authorities and other key stakeholders. The aim is to produce an updated Strategy that is agreed and formally adopted by all the partners.

Humber 2100+ will update the existing strategy to incorporate additional information following the 2013 tidal surge, improved understanding about the estuary and its behaviour, and key changes in the way flood risk management is administered and funded. It will also cover a larger study area than the existing strategy: adding the extremity of tidally-dominant flooding further upstream in the Rivers Ouse, Aire, Don, Trent and Ancholme (see Section 1.3).

[1] Humber Flood Risk Management Strategy, March 2008 https://www.gov.uk/government/publications/humber-flood-risk-management-strategy

Humber 2100+ will develop a Capital Programme (at a strategic level) that will cover all the necessary flood defence improvements, together with the appropriate compliance requirements (such as a continuing programme of habitat creation through managed realignment to ensure compliance with the UK Habitats Regulations) from 2021 to 2121. The project will consider how the Strategy can enable future flood risk management to be adaptive to changing conditions, such as the environment, climate change impacts and funding policies. The project will also develop a whole-life Maintenance Plan (at a strategic level) for all the estuary's tidal defences. This will include such items as erosion protection, outfalls and adaptation to climate change. The affordability of Humber 2100+ will be considered using Defra FCRM-AG and other methods as defined in the economics and funding workstreams.

The results of the Humber 2100+ project will be reported in an updated Strategy document for approval by the Environment Agency, Defra and HM Treasury, accompanied by appropriate parallel documents and summaries to allow engagement with the public and key stakeholders. Once Humber 2100+ is approved and adopted by all the partners, its programme will feed the detailed programmes of flood risk management activities for delivery post-2021. During the development of Humber 2100+, various environmental studies will be completed to comply with legal requirements, including SEA and Habitats Regulations Assessment (see Section 2.8) and to inform option appraisal. For example, these assessments will help to identify options that work with natural process and provide sustainability benefits (social, environmental, economic). The new assessments will refer to and build on the previous assessments completed for the original strategy[2], including the original SEA and Habitat Regulations work (a shadow Appropriate Assessment in 2005 and approved HRA in 2011, following the change in legislation).

1.3 Humber 2100+ study area

The Humber Estuary is one of the North Sea's principal estuaries, with a catchment approximately one fifth of the land area of England. The estuary area includes homes of more than 400,000 people; 205,000 properties and 32,500 businesses including major industrial and commercial properties; the country's largest port complex; and extensive areas of highly productive farmland. The estuary area is at risk of being flooded by a storm surge in the North Sea, and is protected to varying standards by existing flood defences. Most of these people are in cities such as Hull and large towns such as Grimsby, or in smaller towns or villages. Most of the study area is farmed and consequently has relatively few people living on it: the hinterland of the estuary supports high quality agriculture. The area contains the UK's largest ports complex (Goole, Hull, Immingham /Grimsby) and other major industries such as power stations and refineries. The whole area is of heritage interest and the estuary itself is protected by national and international designations due to its importance for nature conservation, particularly for inter-tidal habitats and birds.

The study area for Humber 2100+ is shown below in Figure 1. It comprises the area of tidally-dominant flooding around the Humber Estuary and in the lower reaches of the Rivers Ouse, Ancholme, Aire, Don and Trent (extending further upstream and along the coast compared with the existing Strategy). The study area covers either in full or part of the following local authorities and county councils:

- East Riding of Yorkshire
- City of Kingston upon Hull
- North Lincolnshire
- North East Lincolnshire
- West Lindsey
- East Lindsey
- Bassetlaw District Council
- Doncaster Metropolitan Borough Council
- Selby District Council
- North Yorkshire County Council

[2] HEFDS Strategy Development Study SEA Environmental Report (Halcrow and Black & Veatch, June 2005)

- Nottinghamshire County Council
- Lincolnshire County Council

The existing Strategy and accompanying SEA (Halcrow and Black & Veatch, 2005) divided the Strategy study area into 27 'flood cell' units. Humber 2100+ is likely to have different units from that of the original Strategy and these will be determined at a later stage. For the purposes of this Scoping Report, the baseline information is presented by local authority and will be refined further when details of the Strategy flood cells become available.

Note that there has been a revision to the Strategy study area boundary since publication of the Scoping Report Consultation version in December 2017, to the 7m LiDAR contour. The revised boundary now includes:

- more areas to the south of Selby (Balne, Walden Stubbs);
- some areas in the north of Doncaster district (Campsall and Norton) and the east of Doncaster district (Hatfield Chase);
- more area to the east at the mouth of the Humber; and
- more of the coasts of North Lincolnshire, West Lindsey district, North East Lincolnshire and East Lindsey district.

Where it was useful for the SA and for the Strategy to note and where the data was available, the SA used a sub-regional level of information. For example, this level of detail was used for the economic growth discussions, and information on Yorkshire and Humber (which cover most of the study area extent), East Midlands, and Doncaster and Bassetlaw areas.

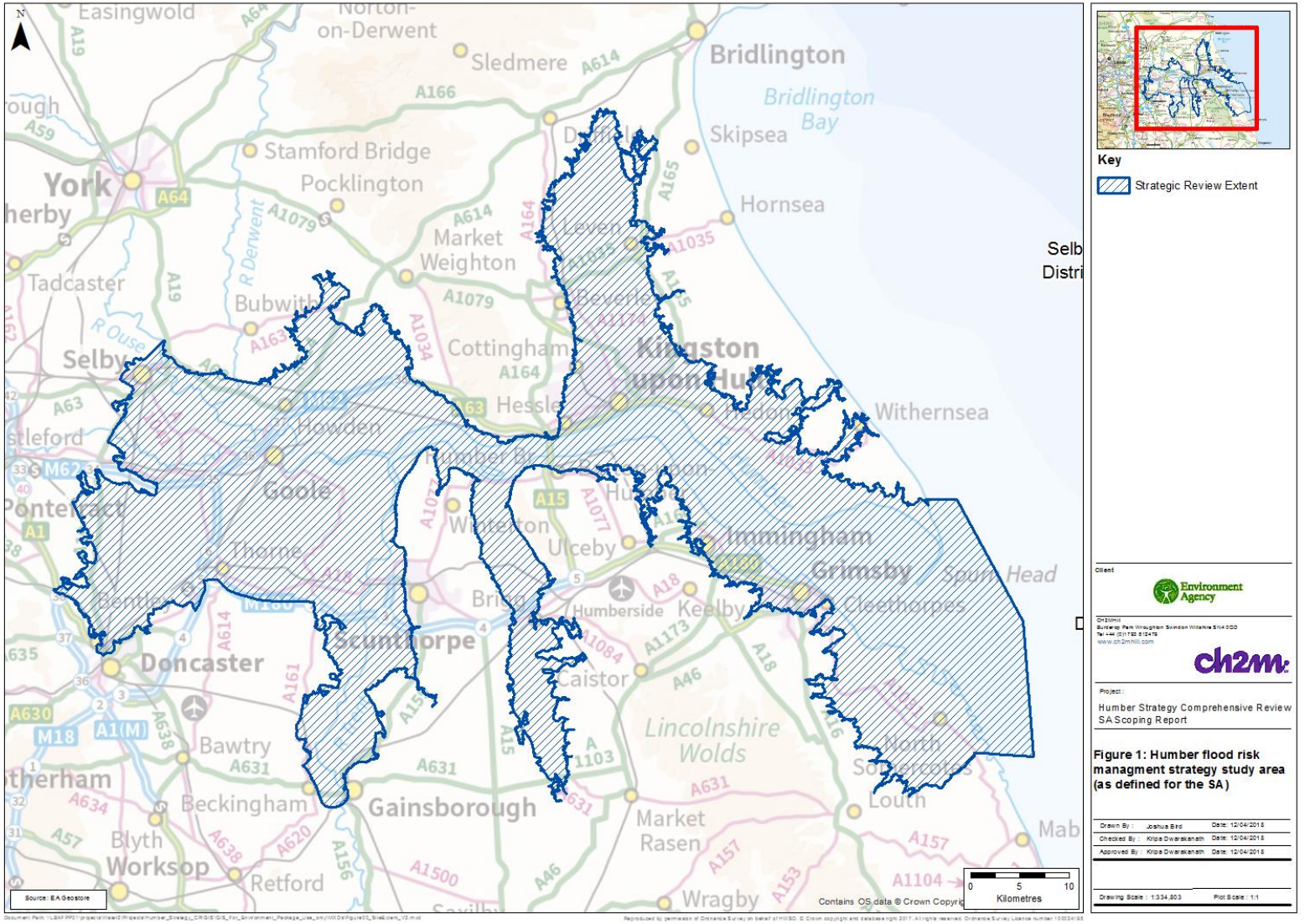

Figure 1 Humber 2100+ study area (as defined for the SA)

1.4 Flood risk management

1.4.1 Flooding history

The Humber Estuary has had a long history of flooding. The most damaging storm surge on record in the North Sea struck the east of England on 31st January 1953, leading to the loss of 300 lives, damaging 24,000 homes and flooding almost 100,000 ha of land between Yorkshire and the Thames Estuary. Following this, the flood defences around the Humber Estuary were improved.

Flood protection is provided by approximately 400km of flood defences along the estuary and tidal reaches of the main tributaries, largely comprising grassed earth embankments, heavier rock or stone protected banks and sheet piled or concrete walls in industrial areas.

Most recently, a major tidal surge in December 2013 resulted in overtopping and damaging defences around the Humber Estuary. Approximately 1,170 properties were flooded, 1,500 people were evacuated and around 7,000ha of land was flooded.

The 2013 floods affected many residents and businesses on the north and south banks of the Humber and in the tidal reaches of the tributaries, and communities affected included Kilnsea, Hull, Hessle, Reedness, South Ferriby (see Figure 2), New Holland, Cleethorpes, and Immingham.

Figure 2 Flooding at South Ferriby and Winteringham Ings, December 2013

Since the 2013 surge, defences were inspected immediately and urgent repairs have been completed. The flood defences around the Humber Estuary were tested again by another tidal surge in January 2017.

Records show that water levels in the Humber are rising, and the rate is predicted to increase because of climate change. Unless action is taken, this will increase flood risk in many areas. In addition, this is causing loss of intertidal habitats within the estuary due to coastal 'squeeze' (i.e. where inter-tidal habitats cannot migrate inland with rising sea levels due to presence of defences). A full review of flood risk around the Humber Estuary will be completed during the development of Humber 2100+.

1.4.2 Other flood risk management strategies

Since 1997, the Environment Agency has been developing a long-term strategy for managing flood risk around the Humber Estuary and the lower reaches of its main tributaries, resulting in the production of many flood risk management plans. The most relevant of these are discussed below.

The Humber Estuary Shoreline Management Plan HESMP (Environment Agency , 2001) identified that in much of the estuary the best approach is to keep the defences where they are. It highlights however, that there are places in the estuary where adopting a different line of flood defences will make the whole system (estuary, defences and area protected) more effective and sustainable.

The Humber Coastal Habitat Management Plan (CHaMP) (Environment Agency , 2005) was produced to inform the development of a more detailed strategy to manage the risk of flooding around the Humber Estuary. It assessed the amount of intertidal habitat likely to be lost due to coastal squeeze and the construction of new or improved flood defences over the following 50 years. It also set out the rate at which replacement habitat should be provided to meet the requirements of the UK Habitats Regulations.

Building on the HESMP and CHaMP, the Humber Flood Risk Management Strategy was published in 2008, as described in section 1.2.

The Flamborough Head to Gibraltar Point Shoreline Management Plan (Scott Wilson, 2010) provides a strategy for the east coast at the Estuary mouth and has considerable overlap with this Strategy's study area, from Immingham to Saltfleet on the south bank, and Sunk Island to Easington on the north bank.

The Humber River Basin District Flood Risk Management Plan (Environment Agency, 2016) was written after the approved Strategy as it was a statutory plan under The Flood Risk Regulations 2009, which transposed the EU Floods Directive into UK law. It refers to the Humber Flood Risk Management Strategy as the key plan for managing flood risk around the estuary.

The Estuary's larger tributaries also have relevant strategies whose study areas will overlap or are adjacent with the new Strategy, some of which are draft: The River Hull Integrated Catchment Strategy, River Aire Strategy, Isle of Axholme Strategy, River Ouse Strategy, Tidal Trent Strategy, River Don Strategy, the River Derwent or Dutch River. Unpublished reports, where available have been reviewed to inform the SA.

Note that the relevant areas covered by the strategies discussed in this section will, in part, be incorporated in the Strategy.

1.5 Background to Sustainability Appraisal and Strategic Environmental Assessment

1.5.1 Purpose of SA and SEA

By identifying strategic level sustainability issues that can guide Humber 2100+ development and be carried through to schemes, the SA aims to ensure that individual schemes are developed with sustainability in mind. Potential cumulative effects are thereby assessed at an early stage, preventing a situation in which detailed schemes are developed that subsequently have to be rejected, or fundamentally redesigned in order to comply with legislation or other environmental requirements and to avoid conflict with socio-economic features and planned economic growth.

The SA process is integral to Humber 2100+ development by advising on the potential environmental, social and economic impacts of the options and associated opportunities for improving sustainability. The SA has distinct stages, which influence the development of the Strategy at key points in its programme. The SA methodology and relationship with Humber 2100+ are described in section 2.

1.5.2 Regulation and legislation

SA and the SEA processes help public authorities such as local planning authorities and the Environment Agency to contribute to the achievement of sustainable development in preparing their plans and strategies through a structured assessment of their proposals and policies in terms of key sustainability issues - social, environmental and economic factors. DEFRA Flood and Coastal Erosion Risk Management Policy (DEFRA, 2009) states 'Environmental appraisal techniques, using the structured methodology (be) employed in a Strategic Environmental Assessment (Reference 17) or Environmental Impact Assessment should be utilised to describe

the full range of impacts on the human, cultural, historic and natural environment of all options.' Therefore, a SEA will apply to the Humber 2100+. In addition, the Environment Agency is committed to working with key stakeholders i.e., local planning authorities who conduct SA in their plan making process; therefore, the Environment Agency has decided to prepare a SA for Humber 2100+, which will also integrate the legal requirements of SEA. Hereafter, SA refers to an integrated SA and SEA[3].

1.5.3 Overview of SA stages and consultation

An overview of the stages of development for Humber 2100+ in relation to the stages of the SA is summarised in Table 1.1 below. More detail of the SA methodology for each stage is provided in Section 2.4.

The statutory bodies (Consultation Authorities) for SAs and SEAs in England are Natural England, Historic England and the Environment Agency.

Consultation with the statutory bodies and other key stakeholders has been held and planned for further stages to meet the statutory requirements for consultation on the SEA and add rigour to the appraisal process. The first consultation of the SA Scoping report was held between December 2017 and January 2018 and this report has been updated based on the consultation comments to form this SA Final Scoping Report.

Table 1.1 Overview of Humber 2100+ development stages, SA stages and key consultation

Humber 2100+ Development Stage	SA Stage	Objective	Purpose
Data collection and analysis to inform Strategy	Scoping	To gather readily available information about the sustainability aspects (baseline data) and other relevant plans and strategies.	Define and confirm the current state of the social, economic and environmental receptors, confirm the key sustainability issues related to Humber 2100+ , and identify the sustainability objectives relevant to the Strategy. **Consultation on the draft Scoping Report (consultation version).** Update following consultee comments to produce the **Post-consultation SA Final Scoping Report (this report)**
	Scoping Consultation	To consult on the scope and level of detail required for the SA.	
Develop and assess initial Strategy options	Initial options appraisal	Identify potential long list and short list FRM options and assess their significant sustainability effects and consult on the initial options with stakeholders. Identify measures to avoid, reduce or offset negative effects or maximise the positive effects.	Influence the selection of the short list options using the results of the long list assessment. Document the outcomes of consultation on the Initial options to feedback into the selection of the preferred Strategy option. Consultation on the Initial Options Appraisal Report.
Draft Strategy	Preferred option Appraisal & SA Report	Consult with stakeholders on the draft Strategy and the results of the SA	Document the outcomes of the SA of the draft Strategy in a SA Report and obtain feedback from consultees.

[3] For further information on SA and SEA see UK Government DCLG planning guidance website: https://www.gov.uk/guidance/strategic-environmental-assessment-and-sustainability-appraisal

Humber 2100+ Development Stage	SA Stage	Objective	Purpose
			Consultation on the preferred option(s) appraisal using the SA Report
Strategy adoption	Adoption stage, to prepare SA Post Adoption Statement	To adopt the Strategy and show how the economic, social and environmental issues and consultation feedback has been taken into account.	Document feedback on the SA Report and demonstrate how the SA process has influenced the Strategy preparation. Publish the Strategy, seek approval from Defra and provide a Post Adoption Statement for publication as soon as the Strategy is adopted, detailing the SA process and the role in Strategy preparation.

1.6 Report structure

This report is structured as follows:

- Section 1- Introduction;
- Section 2 - Methodology to be adopted for all stages of the SA, with details on determination of significance of effects;
- Section 3 – Regulations, Policies and Plans review - a key activity at the scoping stage, which will inform development of the SA Framework. (See Appendix 1);
- Section 4 - Social and Economic Factors Baseline section, which discusses social and economic themes that are relevant to the SA Framework and will inform future appraisal stages;
- Section 5 - Environmental Baseline section, which discusses relevant environmental themes that are relevant to the SA Framework and will inform future appraisal stages. (The figures are given in Appendix 2, and the additional information in Appendix 3);
- Section 6 - Sustainability Appraisal Framework, which discusses which social, environmental and economic topics will be scoped in or scoped out of the SA and the reasons. It presents the SA Framework with objectives, criteria and indicators. The Framework will be refined upon receipt of consultation responses to this report and it will be used to appraise the Humber 2100+ options in the subsequent stages. This section also includes discussion on compatibility testing between SA and Strategy objectives;
- Section 7- Next steps.

2. Methodology

2.1 Study area

The study area for the SA of Humber 2100+ will predominantly follow the area where flood risk management options are planned and where these options are predicted to have a significant impact - positive or negative. For the purposes of the Scoping Report, it will initially adopt the new Strategy study area (see Section 1.3) comprising the area of tidally-dominant flooding around the Humber Estuary, including the lower reaches of the Rivers Ouse, Aire, Don, Ancholme and Trent.

Other parallel studies, described in Section 2.8, will inform the SA and influence the study area. The other studies will also discuss impacts on potential environmental, economic and social receptors.

Due to the various parallel studies, and the variation in impact magnitude between the different environmental, social and economic topics, the SA study area may vary. A review of the study area will therefore be undertaken as the parallel studies develop and findings emerge, and, if necessary, modified for later stages of the SA if impacts are anticipated outside the Humber 2100+ study area.

2.2 Data sources

Key data sources used to build an understanding of the environmental, social and economic baseline presented in this Scoping Report are listed below. These comprise publicly available data from online sources and information from the Environment Agency and partners, including GIS-based data from most local authorities within the study area. The key data sources included:

Plans and reports

- Department for Communities and Local Government guidance on SA
- Websites of local authorities and county councils located within the study area for Local Plans and other planning documents
- River Basin Management Plan, Shoreline Management Plans, Coastal Habitat Management Plan and the previous Humber Flood Risk Management Strategies (and related documents)
- Studies within the Humber Estuary on environmental and economic aspects
- Website of the Humber and Lincolnshire Local Economic Partnership.

GIS data layers

- Environment Agency
- Local Authorities
- MAGIC, Defra websites
- Internal Drainage Boards (for example Shire Group IDB)
- Natural England
- Historic England.

2.3 Limitations

Baseline data gathered are typically from online sources for reports and statistics, and GIS layers on various topics were requested from local authorities that fall within the study area. We are grateful to all authorities who supplied the information, however this was not received from all authorities, hence there are gaps in data sets (shown in the figures in Appendix 2).

Some unpublished reports, made available by the Environment Agency, were used to inform the plans and policies review and baseline sections of this report (sections 3 and 4); it is likely that similar reports are available

with partner organisations which we were not able to access at the time of writing this report, subsequently gaps in baseline reporting may exist.

2.4 SA approach

The SA, incorporating a SEA, will assess the sustainability performance of the Humber 2100+ proposals. The approach is based on the DCLG Guidance on the SA of Plans, Policies and Programmes (2005). It follows four stages, which are continuously linked to the preparation of the Strategy: (i) Scoping; (ii) Initial Options Appraisal; (iii) Preferred Option Appraisal; and (iv) Adoption/Strategy Submission..

The main steps in the SA are discussed in sections 2.4.1 to 2.4.4 below.

2.4.1 Scoping

Scoping is the first step in SA, is the current stage of the Humber 2100+ SA. This stage involves:

- *Baseline setting for the study area*: This is a fundamental step in the SA process as it helps to identify the environmental, social and economic status against which changes can be measured. It helps define key issues and potential opportunities for Humber 2100+ and helps develop a robust SA Framework (see below). Data sources identified in section 2.2 inform the basis for the analysis. See sections 4 and 5 for the findings.
- *Relevant legislation, plans and policies review:* This step helps to inform the team of relevant legislation, plans and policies that may have implications or influences on the SA and the Strategy, and therefore need to be considered in developing the SA Framework.
- *SA Framework development*: Based on the baseline setting and analysis of relevant plans, policies and programmes, key issues and opportunities are identified to enable specific SA objectives to be developed for economic, environmental and social themes that are relevant to Humber 2100+. The framework (provided in Section 6 of this report) also includes sub-objectives/ assessment criteria which will be used to guide the assessment of Strategy options.
- *Scoping Report - consultation version:* The SA Scoping Report reports on the findings of the baseline setting, identification of relevant issues and opportunities, and the plans and policies review and presents the proposed SA Framework. A test on the compatibility of the SA objectives and the Humber 2100+ objectives was included. The first version was prepared for consultation.
- *Consultation:* The SA Scoping Report consultation version was presented for consultation with statutory bodies and other key stakeholders, including Natural England, Historic England, Marine Management Organisation, Local Planning Authority teams (planning and flood risk) and Environment Agency teams, and other relevant bodies, such as the Yorkshire and Lincolnshire Wildlife Trusts and RSPB, between December 2017 and January 2018, adhering to the statutory consultation period prescribed in the SEA Regulations (five weeks).
- *Final Scoping Report – post consultation version:* After the five-week consultation period, the responses were collated and analysed. Based on the responses, some baseline and policies information has been revised and the SA Framework refined in order to prepare the Final Scoping Report (this report). Details of the consultation responses and how these have been taken into account in this report are provided in Appendix 4.

2.4.2 Initial Options Appraisal

The second stage of the SA will provide assessments of the Humber 2100+ options being considered on the long list of options, followed by the short list. The main steps in the SA in this stage will be:

- *High-level appraisal of long list:* Using the SA objectives in the agreed SA Framework, a high-level appraisal of the long list will be conducted against the SA objectives integrated into the wider appraisal work. A high-level summary of the environmental, economic and social issues, where key adverse impacts and opportunities will be recorded. These sustainability findings will be used by the Humber 2100+ team to inform the development of the options and influence the selection of the short list.

- *More detailed appraisal of short list:* A more detailed appraisal of the options that remain on the short list will be conducted using the agreed SA Framework (and see evaluation method in section 2.5.1). The appraisal is reliant on expert judgement informed by the baseline and consideration of the possible probability, frequency, reversibility, magnitude, timing and spatial extent of potential effects, and the sensitivity of the receptor. The short-listed options, barring the ones which may be developed into a preferred option in the future stages, will be considered as 'reasonable alternatives[4]'. A 'do-nothing' option will also be appraised as a comparator.
- *Initial Options SA Report:* Findings of the 'do-nothing', long list and short list options appraisal will be consolidated into an Initial Options SA Report, prepared for consultation.
- *Consultation:* Although it is not defined as a requirement for a SA, consultation on the Initial Options SA Report is a widely-accepted practice in the Local Plan preparation process, which is recommended to replicate. The consultation period will run for five-weeks.

2.4.3 Preferred Options Appraisal

This stage of the SA will complete the main assessment of the Humber 2100+ preferred options. The main steps in the SA in this stage will be:

- *Preferred option assessment:* A detailed assessment of the preferred options against the agreed SA objectives in the Framework will be conducted (and see evaluation method in section 2.5.1). The temporal and spatial scale will be discussed, along with commentary on the identified impact of the preferred options.
- *SA Report:* The SA Report will include assessment findings of the preferred options, 'do-nothing' option, 'reasonable alternatives' as well as cumulative, synergistic and secondary effects identified. For the purposes of this study, typical mitigation applied through regulation will be assumed and only 'residual' effects will be reported as predicted effects. A Mitigation and Monitoring Framework will be developed for the options that will be finalised and presented as part of the SA Report.
- *Consultation:* The SA Report will be presented along with the draft Humber 2100+ Strategy for consultation with identified stakeholders.

2.4.4 Adoption/Strategy submissions

This stage of the SA will provide the final SA documents for submission with the finalised Strategy documentation for approval. The main steps in the SA in this stage will be:

- Statement of Environmental Particulars: Consultee comments on the SA Report and responses will be recorded in a Statement of Environmental Particulars, unless significant changes to the draft Strategy preferred options are proposed post-consultation. If any significant changes are made to the Strategy options, re-appraisal and re-consultation of the amended SA Report will be undertaken. Due to an overlap in the purpose and content, the Statement of Environmental Particulars could potentially be combined with the Draft Adoption Statement document described below. This will be determined at the SA Report stage.
- Draft Post-Adoption Statement: a draft Post-Adoption Statement will be prepared so that a statement is ready for publication as soon as possible upon adoption of the Strategy. It will set out how the SA findings and consultation responses have been taken into account.
- Approvals submission: The finalised updated Strategy and Business Case will be submitted, accompanied by the SA Report, Statement of Environmental Particulars and a draft SA Post-Adoption Statement, for approval by the Environment Agency, Defra and HM Treasury. Once the Strategy is approved and adopted by all the partners, the Post-Adoption Statement will be published.

[4] UK Government guidance website states, '*Reasonable alternatives are the different realistic options considered by the plan-maker in developing the policies in its plan. They must be sufficiently distinct to highlight the different sustainability implications of each so that meaningful comparisons can be made. The alternatives must be realistic and deliverable*'. It is important to assess reasonable alternatives to the same degree as one would appraise the preferred options.

2.5 Describing effects and their significance

2.5.1 Evaluation of effects

The SA will be an expert judgement-based assessment, supported by appropriate evidence and we will use experience gained by conducting SEA of other flood risk management strategies and from conducting Local Plan SAs. Where appropriate, the assessment will utilise mapping data and GIS to identify areas of potential impact, for example due to erosion risk or presence of environmental designations. Up-to-date, locally-specific environmental, social and economic data will be used to inform the impact assessment. For example, the SA will refer to specific areas targeted for economic development, through stakeholder engagement and using site allocations data obtained from local planning authorities and Local Economic Partnerships.

The assessment will focus on impacts associated with tidal flood risk. This assumes a flood risk baseline year of 2021. Impacts associated with other forms of flood risk will be considered as part of the cumulative impact assessment (see Section 2.5.3).

The impacts described in the SA will be those expected under 'do nothing', 'do minimum' and 'status quo' baseline scenarios for tidal flood risk. These scenarios will be described in the SA report commentary in relation to each SA topic, to allow easy comparison between each scenario and the flood risk management options.

The 'do nothing' scenario enables a comparison to be made with how the risk of flooding would look in the absence of the Humber 2100+ Strategy. This approach is consistent with the recommendations of the 2005 ODPM SA/SEA guidance.

The 'do minimum' scenario would effectively mean a reduced Standard of Protection for communities and infrastructure due to sea level rise. The do-minimum approach will be described in the SA report commentary, in relation to each of the SA objectives and for each flood area.

The 'status quo' scenario will assume we continue to deliver the existing 2008 Humber Strategy.

For the assessment of short listed and preferred options, the achievement of SA objectives will be considered against the baseline. This means that, where defences are already present, and the option is to maintain the existing defence line, then the option would have a neutral effect on properties affected, i.e. no change from the present day. However, the option may have a negative effect for the future with sea level rises linked to climate change scenarios.

The potential effects of the short listed options and the preferred options will be described in terms of their nature, permanence, spatial scale and duration, as shown in Table 2.1, with their significance criteria provided in Table 2.2. Due to the strategic nature of the assessment, and the multiple variables to consider, there will always be a significant level of uncertainty in the assessment.

Table 2.1 Aspects that will be used to describe the identified effects of the proposed strategy and options

Aspect	Descriptors to be used
Nature	Positive (+) Negative (-) Neutral (N) Uncertain (?)
Permanence and reversibility	A permanent effect (P) is one which results from a physical change that is anticipated to last beyond the life of the Strategy (i.e. 100 years) A temporary effect (T) is one which results from an operational change which results from an operational change which could change if there is a change of policy, or a short-term condition, which is anticipated to reverse in the future. A reversible effect (R) is an effect that can be revered, for example an incident of water pollution can be cleaned up over time.

Aspect	Descriptors to be used
	An irreversible effect (I) is an environmental effect that cannot be reversed such as the loss of a historic feature or the loss of agricultural soil due to permanent development.
Spatial scale	Local (L): effect is restricted to a specific site or settlement within the study area. Regional (Re): effect is anticipated to cover a significant proportion of Humber and/or North Lincolnshire, North Yorkshire (part) and surrounding areas. National (N): effect covers the whole of England and/or the UK (also includes international).
Duration	Effects expected from the construction or operation of the proposed option(s) in the short term (ST), medium term (MT), and long term (LT). The timescales are to be determined once the number and duration of the Strategy epochs are defined, to allow comparison between the epochs and impact duration.

Table 2.2 Criteria to determine significance of identified effects of strategy options against the SA objectives

Significance	Symbols	Description
Major positive	++	The option would be significantly beneficial and contribute to the achievement of the SA objective by helping to resolve an existing social, economic or environmental issue and/or maximising opportunities for enhancement*.
Minor positive	+	The option would be partially beneficial and contribute to the achievement of the SA objective by helping to resolves an existing social, economic or environmental issue and/or offering opportunity for some enhancement. This effect would not be considered significant.
Neutral	N	The option would have a neutral effect in terms of achieving the SA objective, i.e. no change from the present day.
Uncertain	?	There is insufficient detail available on the option or the baseline situation to assess how significantly achievement of the SA objective would be affect by the option.
Minor negative	X	The option would partly undermine achievement of the SA objective by contributing to a social, economic or an environmental problem and/or partially undermine opportunities for any enhancement. This effect would not be considered significant.
Adverse (major negative)	XX	The option would significantly undermine achievement of the SA objective by contributing to a social, economic or an environmental problem and significantly undermine opportunities for any enhancement. This effect would be considered significant.

*Enhancement means going beyond mitigation on and/or to improve existing baseline condition

For the assessment of short-listed options and the likely preferred options, achievement of SA objectives will be considered against the baseline. This means that where defences are already present and the option is to maintain the existing defence line, then the option would have a neutral effect on properties affected, i.e. no change from the present day. However, the option may have a negative effect for the future with rises in sea level linked to climate change.

It is important to recognise that the baseline in the study area is evolving and will continue to evolve during the Humber 2100+ development, and after the adoption of the new Strategy, given the changing flood risk over time and the long-time period of the plan. For example, changes to bird populations and distribution in the

estuary are likely and in some cases irrespective of changes in flood risk. The possible trends in the baseline are presented in sections 4 and 5 of this report because the evolution of baseline needs to be considered in appraising the options, where practicable.

In addition, to enable a comparison to be made with how the risk of flooding would look in the absence of the Strategy, a scenario of 'do nothing' will be considered. This approach is consistent with the recommendations of the 2005 ODPM SEA guidance. Typical mitigation measures applied through regulation will be assumed and only 'residual' effects will be reported as predicted effects. No other Strategy-specific mitigation, unless stated, will be assumed. However, within this assessment, strategic mitigation measures will be recommended for any identified significant adverse effects.

2.5.2 Mitigation

Strategic mitigation measures will be recommended for any identified significant adverse effects. Mitigation measures applied at the strategic level will not be assumed in the scoring assessment. Mitigation and enhancement measures will be described in the Initial and Final SA Report text commentary, which will also describe predicted 'residual' effects after mitigation measures have been taken into account.

2.5.3 Cumulative, secondary and synergistic effects

Cumulative effects may arise where several developments each have insignificant effects but together have a significant effect. These may include the following:

- **Secondary or indirect** effects are effects that are not a direct result of the Strategy, but occur away from the original effect or as a result of a complex pathway. Examples of secondary effects are a development that causes hydrological changes and thus affects the ecology of a nearby wetland; and construction of one project that facilitates or attracts other developments.
- **Cumulative** effects arise, for instance, where several developments each have insignificant effects but added together have a significant effect; or where several individual effects of the plan (e.g. noise, dust, visual) have a combined effect.
- **Synergistic** effects interact to produce a total effect greater than the sum of the individual effects. Synergistic effects often happen as habitats, resources or human communities get close to capacity. For instance, a wildlife habitat can become progressively fragmented with limited effects on a species until the last fragmentation makes the areas too small to support the species at all.

Cumulative effects will be assessed at the preferred option(s) SA stage. There are significant levels of uncertainty associated with cumulative effects assessments, as they are largely based on subjective extrapolations, as recognised in the ODPM SEA Guidance.5

2.6 Consultation

Consultation with key stakeholders is planned at various stages of the SA. See Table 1.1 for consultation that has been completed and is planned.

Consultation on the Scoping Report has been completed. We thank the consultees from partner organisations who have identified a few additional sources, particularly policies and projects, during the SA Scoping Report consultation process. A record of consultation responses is provided in Appendix 4.

2.7 Inter-relationship with the Strategy-making process and SA process

The SA process is integral to Humber 2100+ development. The SA stages interact with the Strategy at key points of the programme, as described in Section 2.4, to help inform decision-makers about potential environmental,

[5] ODPM, 2005. A Practical Guide to the Strategic Environmental Assessment Directive. Practical guidance on applying European Directive 2001/42/EC "on the assessment of the effects of certain plans and programmes on the environment". Office of the Deputy Prime Minister, September 2005.

social and economic impacts of the options. The main areas the SA will influence the Strategy will be through advising on the sustainability issues and opportunities during:

- the appraisal of options (on the long and short lists);
- selection of the preferred options; and
- development of the preferred options, enabling them to be modified to improve their environmental, social and economic performance.

It is important that the consultation on the SA Framework (which is a statutory requirement for the SEA element of this SA) via this Scoping Report is completed before the Strategy appraises the options (long list and short list). A high-level version of the SA framework of objectives will be incorporated in the Strategy options appraisal methodology (Appraisal Summary Table), integrating the two appraisals processes further.

The SA findings and consultation responses will be shared with the team members, client and partners who will be developing, reviewing and approving the Strategy at various stages, through team discussions, workshops and reports. The influence of the SA on the Strategy-making process will be reported in the Post-Adoption Statement.

2.8 Connections with other studies and assessments

2.8.1 Habitats Regulations Assessment

The Habitats Directive is transcribed into UK law by The Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations')(see Section 3.1). The project will complete a Habitat Regulations Assessment (HRA) of the preferred options to comply with the Habitat Regulations.

The Habitats Regulations require that where it is not feasible to prevent the deterioration of a Natura 2000 site, i.e. where a scheme will result in likely significant effects and adverse effects on the integrity of the site, but where there are no environmentally better alternatives and there are reasons of overriding public interest for the scheme to take place, compensatory measures should be taken to maintain or enhance the overall coherence of the Natura 2000 network. Compensatory measures can include creating habitat on a new or enlarged site, to be incorporated into the Natura 2000 network (European Commission, 2000). These would need to be set out for approvals in an 'appropriate assessment', reported in the HRA, as was done for the existing Strategy.

Information from the HRA will support the SA appraisal of options against biodiversity objectives relating to the Natura 2000 sites.

2.8.2 Water Framework Directive Assessment

The Water Framework Directive (WFD)[6] 2000 requires all natural water bodies to achieve both good chemical status and good ecological status. Water bodies that are designated in the River Basin Management Plan (RBMP) as Heavily Modified Water Bodies (HMWB) or Artificial Water Bodies (AWB) such as the Humber, may be prevented from reaching good ecological status by physical modifications (e.g. navigation, flood defence, urbanisation). Instead they are required to achieve Good Ecological Potential (GEP), through implementation of a series of mitigation measures outlined in the applicable RBMP.

The project will complete a WFD compliance assessment of the preferred options to identify the likely effects on the waterbody and WFD status, including cumulative effects, alongside recommendations for achieving GEP through flood risk management-related mitigation measures.

[6] Water Framework Directive (Directive 2000/60/EC), implemented in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations (SI 3242/2003).

Information from the WFD assessment and recommended WFD mitigation measures will support the SA baseline setting and appraisal of options against SA objectives relating to the water environment, and refinement of the preferred option to improve sustainability performance.

2.8.3 Landscape, green infrastructure and investment studies

The project will be developing a detailed narrative for the study area that highlights the key opportunities where investment in flood risk management works could be integrated with landscape and green infrastructure opportunities, if additional funding was available. This work will also be considering the less tangible benefits of delivering flood risk management works, such as benefits related to the health system, social services, and infrastructure.

Information from this work will support the later stages of SA at appraisal of options against social, environmental and economic SA objectives relating to landscape and green infrastructure and less tangible benefits of the Humber 2100+ Strategy.

3. Regulations, Policies and Plans Review

3.1 Introduction

Flood risk management is subject to many pieces of international and national legislation. Since much of the international legislation relevant to the Humber 2100+ Strategy is implemented through the national and local level policies and plans, only the national, regional and local policies and plans relevant to the new Strategy have been reviewed. For example, the EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora has been transposed into national legislation as The Conservation of Habitats and Species Regulations 2017.

Recognising the UK's current EU exit process, the position of the Environment Agency is as follows: while the UK remains a member of the EU we must continue our business as usual and implement and enforce all EU law, unless an exception to this has been specifically stated. The EU (Withdrawal) Bill will convert all EU law into UK law, and will only allow the UK to make amendments are leaving the EU. We will continue to ensure compliance with EU directives beyond the UK's exit from the EU until such a time that they cease to be required under UK law.

A comprehensive list of national and local policies and plans is provided in Appendix 1. A summary of the key messages from this review is presented below.

3.2 Regulations

The Conservation Habitats and Species Regulation 2017.

Known as 'The Habitats Regulations', these Regulations consolidate and update the Conservation of Habitats and Species Regulations 2010 (the "Habitats Regulations 2010"). The Conservation of Habitats and Species Regulations 2017 ("the Habitats Regulations 2017") transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive) and elements of Directive 2009/147/EC on the conservation of wild birds ("the Birds Directive") in England, Wales and, to a limited extent, Scotland and Northern Ireland.

These regulations continue to provide for the designation and protection of 'European sites' (SACs and SPAs) or a 'European Marine Site' and the protection of 'European protected species' listed in Schedule 2. The Regulations require competent authorities to carry out an appropriate assessment in circumstances where a plan or project is likely to significantly affect a European site or a European Marine site (see section 2.8.1).

Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (SI 2003/3242).

The main objectives of the Water Framework Directive are to protect and enhance surface freshwater (including lakes, streams and rivers), Transitional and Coastal (TraC) waters, groundwaters and dependant ecosystems. The Environment Agency is the 'competent authority' in England and Wales responsible for implementing the regulations.

The Wildlife and Countryside Act 1981 (as amended).

Sites are notified as Sites of Special Scientific Interest under this Act for their important flora, fauna, geological or physiographical features, Limestone Pavement Orders, and Marine Nature Reserves. Assent from Natural England for operations by the Environment Agency is required under Sections 28H and 28I (Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000) before any works which might adversely affect a SSSI are undertaken. Sections 28G-I place duties on public bodies to further the conservation and enhancement of SSSIs, both in carrying out operations and in exercising decision-making functions. The Act also allows for the protection of wildlife (birds, some animals and plants) listed in Schedules 1, 5 and 8.

Marine and Coastal Access Act 2009

Provides a legal mechanism to help ensure clean, healthy, safe, productive and biologically diverse oceans and seas by putting in place a system for improved management and protection of the marine and coastal environment. The Act introduced a new system of marine management. This included a new marine planning system, which makes provision for a statement of the Government's general policies, and the general policies of each of the devolved administrations with regard to the marine environment, and also for marine plans which will set out in more detail what is to happen in the different parts of the areas to which they relate. The Act includes provision for changing the system for licensing the carrying on of activities in the marine environment. It provides for the designation of marine conservation zones (MCZs). It changes the way marine fisheries are managed at a national and a local level and modifies the way licensing, conservation and fisheries rules are enforced. It allows for designation of an Exclusive Economic Zone for the UK, and for the creation of a Welsh Zone in the sea adjacent to Wales. The Act also amends the system for managing migratory and freshwater fish, and enables recreational access to the English and Welsh coast.

3.3 National Policies and Plans

A Green Future: Our 25 Year Plan to Improve the Environment, 2018.

The 25 Year Environment Plan sets out government 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. It calls for an approach to agriculture, forestry, land use and fishing that puts the environment first. The plan commits the government to championing sustainable development, lead in environmental science and innovate to achieve clean growth and increase resource efficiency to provide benefits to both our environment and economy.

Countryside and Rights of Way (CROW) Act 2000.

Makes some amendments to the Wildlife and Countryside Act (1981) and provides additional protection to Areas of Outstanding Natural Beauty and Public Rights of Way.

The National Flood and Coastal Erosion risk Management Strategy for England, 2011.

The Flood and Water Management Act 2010 (section 7) requires flood and coastal erosion risk management authorities to aim to contribute towards the achievement of sustainable development when exercising their flood and coastal erosion risk management functions. The strategy details actions which can be taken to manage flood risk and mitigate impacts on communities and a key theme throughout is inclusion of communities at risk. To mitigate risks the FCERM identified that government will need to work with organisation, individuals and communities to- understand the risks of flooding and coastal erosion; avoid inappropriate development in areas of flood and coastal erosion risk and being careful to manage land elsewhere to avoid increasing risks; build, maintain and improve flood and coastal erosion management infrastructure and systems to reduce the likelihood of harm to people and damage to the economy, environment and society; increase public awareness of the risk that remains and engage with people at risk to make them more resilient; and improve the detection, forecasting and issue of flooding, planning for and coordinating a rapid response to flood emergencies and promoting faster recovery from flooding.

National Planning Policy Framework (NPPF) (Department for Communities and Local Government 2012).

The NPPF sets out the government's planning policies. Of particular relevance to the strategy are policies relating to the historic environment, biodiversity and geological conservation, and climate change and flood risk.

Creating a better place - our ambition to 2020, 2016.

This strategy document sets out the Environment Agency's objectives and aspirations for 2020. The objectives are:

- A cleaner, healthier environment which benefits people and the economy.

- A nation better protected against natural threats and hazards, with strong response and recovery capabilities.
- Higher visibility, stronger partnerships and local choices.

Some of the aspirations for 2020 include, increased biodiversity and improved habitat, cleaner water used in a more sustainable way, productive lands and soils, well protected designated sites.

3.4 Regional, sub-regional and local policies and plans

3.4.1 Flood and coastal erosion risk management plans

The Humber Estuary Shoreline Management Plan (HESMP) 2001

Shoreline Management Plans are high level documents that set the long-term policy framework for coastal and estuarine flood risk management. The Environment Agency prepared the HESMP (2001) whose policy recommendations were as follows:

1) Hold the existing defences where there is no justification for moving them.
2) Identify sites where moving the defences will provide flood defence benefits, taking social, environmental and economic issues into account, and establish a programme for moving these defences.
3) Support the creation of new inter-tidal habitat to maintain the estuary's nature conservation status.

The HESMP identified locations throughout the Estuary where the above policies would be pursued, subject to further investigation, and provided a means of communicating these policies to the key consultees and the wider public. The HESMP and Humber Estuary Coastal Habitat Management Plan (CHaMP) (see below) were later developed into the existing Humber FRM Strategy (2008).

Flamborough Head to Gibraltar Point Shoreline Management Plan 2010

The Flamborough Head to Gibraltar Point Shoreline Management Plan was published in 2010, combining the study area of two earlier SMPs, thus superseding them, covering the east coast of England from Flamborough Head to Gibraltar Point. The study area of the Strategy has considerable overlap with this SMP study area, from Immingham to Saltfleet on the south bank, and Sunk Island to Easington on the north bank. The 2010 SMP was developed in cognisance of, and in alignment with, the current Humber FRM Strategy. Any changes now made to the Humber Strategy that have an impact on SMP implementation will be assessed and resolved.

The Humber Estuary Coastal Habitat Management Plan (CHaMP) 2005

The Humber Coastal Habitat Management Plan (CHaMP) (Environment Agency, 2005) was produced to inform the development of a more detailed strategy to manage the risk of flooding around the Humber Estuary. In addition to the increased risk to people, property and land uses, the rising sea levels are causing loss of inter-tidal habitats within the estuary; these habitats are prevented from migrating inland by the existing flood defences (a process known as 'coastal squeeze'). The CHaMP provides a framework for managing sites of European importance and Ramsar sites that are located on or adjacent to dynamic coastlines. The primary functions of the Humber Estuary CHaMP are to:

- provide a clear and agreed record of predicted habitat losses and gains, and other potential impacts on the habitats and species of European or international importance subject to shoreline change; and
- set the direction for habitat conservation measures to address net losses.

The Humber Estuary CHaMP commits the Environment Agendy to compensate for the loss of inter-tidal habitat on the following basis (unless agreed otherwise on a site by site basis or as a result of future Strategy / CHaMP reviews):

- 1:1 replacement for coastal squeeze and temporary disturbance from FRM schemes (1 ha of new habitat for each 1 ha lost), and
- 3:1 replacement for permanent loss due to flood defence works (3 ha of new habitat for each 1 ha lost).

Humber River Basin Management Plan 2015

The RBMP was originally prepared under the Water Framework Directive assessed water body status of the various water bodies in the Humber area and subsequently updated in 2015 to report on the status of the water bodies, state the objectives and design an action plan to achieve the objectives. Key issues affecting the achievement of good ecological potential on the Humber, include physical modification to water bodies (e.g., because of flood defences), pollution from waste water, pollution from towns and cities and changes in water flow. The plan sets out various actions to address the issue of water pollution with an aim to achieve WFD objectives. The plan also informs on land-use planning as land and water resources are linked.

Flood Defences Cost Money, No Flood Defences Cost More: An Economic case for the Humber and United Kingdom 2014

This Briefing Paper summarises the strategic importance of the Humber Estuary to the regional and national economy and its susceptibility to a major tidal surge. It highlights the significant scale of expected damages to the economy from a surge incident equivalent to that experienced in December 2013 but with the added influence of climate change and less favourable wind and tide conditions. The briefing paper presents data relating to the cost of previous flood events and compare against predicted future costs in the event that investment is not procured for the Humber area.

Other flood risk management plans

The main tributaries draining into the Humber Estuary, which are included in the new Strategy study area, have other plans (e.g. Catchment Flood Management Plans (CFMP), Flood Risk Management (FRM) strategies) or draft plans in development. The documents reviewed are the Ouse CFMP, Tidal Trent FRMS, Grimsby and Ancholme CFMP, Aire CFMP, River Don FRMS, Isle of Axholme FRMS and the River Hull Integrated Catchment Strategy (RHICS).

3.4.2 Strategies for economic growth

Northern Powerhouse Strategy

The Strategy, published in Autumn 2016, sets the government's ambition to drive economic growth in the region through investing in improving transport linkages between the Northern cities, work with local authorities to promote education and skills and to establish that the North is an excellent destination for trade and investment.

2014-2020 Strategic Economic Plan (SEP) for the Humber, 2014

Prepared by the Humber Local Enterprise Partnership (LEP) in 2014, this SEP will form the basis of a Growth Deal with Government and will be a determinant of the Humber's allocation of the Local Growth Fund. The SEP is at the centre of the strategic framework through which economic development will be taken forward over the next five years and beyond. The document has five strategic aims-creating an infrastructure that supports growth: supporting businesses through the provision of expert guidance and appropriate finance; ensuring the availability of an excellent standard of housing, town centres and visitor attractions in the Humber LEP area; providing for a skilled workforce; and investing in flood defences and coastal risk management while promoting sustainable development activities.

2018-2022 Eat Riding Economic Strategy (under consultation)

Prepared by the East Riding of Yorkshire Council, the strategy identified four priorities to enable the East Riding to respond to the Government's vision at a local level and complement the ambitions of the Humber Local Enterprise Partnership and the York, North Yorkshire and East Riding Local Enterprise Partnership. The four priorities identified in the strategy are - Business growth; Lifelong learning; Quality locations and Sustainable economy. The strategy aims to build on the East Riding's specialisms, such as those in food, manufacturing and the renewable energy sector, while continuing to address longstanding challenges in productivity, innovation, business growth, skills demand and existing pockets of deprivation in urban, rural and coastal areas.

2015-2025 Strategic Economic Plan (SEP) for the York, North Yorkshire and East Riding LEP, 2016

This SEP forms the basis for ensuring York, North Yorkshire and East Riding Local economy is growing strongly, creating jobs and delivering major economic opportunities for the future. It details how this will be achieved but centrally it comes down to 5 priorities- Profitable and Successful Businesses; A Global Leader in Agri-Food and

Bio-renewables; Inspired People; Successful and Distinctive Places; and a Well-Connected Economy. The SEP has informed the Growth Deal and the Local Growth Fund.

Since securing funding 2017, York, North Yorkshire and East Riding (YNYER) has commenced works on a joint energy strategy with Leeds City Region which will form a Northern Powerhouse Energy Strategy with clear work streams for the M62 and also local network development. Although still in the early stage of development it may become relevant to the Humber Strategy study area.

Growth Ambitions for the Greater Lincolnshire LEP, 2014
Prepared by the Greater Lincolnshire LEP in 2014, the document sets growth ambitions for the region and also sets out series of actions to achieve this. The economic ambitions for Greater Lincolnshire are improved infrastructure; creating the right conditions for business growth; rural enterprise; retail; communications and engagement. The South Humber Industrial Investment Programme (SHIIP) is funded by Greater Lincolnshire LEP.

Sheffield City Region LEP, 2014

This Plan, combined with the Sheffield City Region European Structural and Investment Funds Strategy (ESIF), presents a strategy for accelerating business growth and job creation in the City Region (which includes the south-west of the study area). Over the next 10 years the City Region's ambition is to deliver 70,000 net additional jobs, increase GVA by 10% or £3bn and create 6,000 new businesses. The Plan objectives relate to aiding economic growth, attracting inward investment, enhancing skills of the workforce and infrastructure improvements.

Regeneration & Growth Strategy Bassetlaw District, 2014

Bassetlaw District falls within both the region covered by the D2N2 Local Enterprise Partnerships and the Sheffield City Region and therefore Bassetlaw District council is considered an 'over-LEP' authority. Prepared by Bassetlaw District Council, the document focuses on the long-term objectives for sustainability, positioning the district as an important economic centre outside of the major conurbations of Sheffield City Region and the economic centres covered by the D2N2 Local Enterprise Partnership (LEP).

Although not a plan, the Northern Powerhouse is a government initiative to increase inward investment in the Northern region which involves Local Enterprise Partnerships, academia, local and combined authorities and the private sector. Many projects and investment opportunities are being developed to provide a boost to the Northern region.

3.4.3 Local authority plans

At the time of writing this report the local authorities within the study area were at variable stages of a new Local Plan production process. These plans, when adopted, will replace existing planning policy documents such as Core Strategy but typically will have carried forward most of the saved policies from the Core Strategy. For this reason, we have reviewed draft new Local Plan documents that are in advanced stages of the plan preparation, assuming they will pass the legal test of soundness and will be eventually adopted. This section will be reviewed in the subsequent stages of the SA. Where New Local Plan preparation is in early stages, for example at Issues and Options Stage, we have reviewed the existing Core Strategy document to inform the SA Framework.

The content of the following planning policy documents informed the policies and plans review:

- Adopted East Riding of Yorkshire- Local Plan (2012-2029);
- Adopted East Riding of Yorkshire Councils Local Flood Risk Management Strategy (2015-2027);
- Adopted Kingston upon Hull- Local Plan (2017-2032);
- North Lincolnshire- Core Strategy has been reviewed as the new Local Plan Issues and Options stage has not started; status- not adopted.
- Bassetlaw- a new Bassetlaw Local Plan is in early stages of preparation; status- not adopted. Bassetlaw District Council neighbourhood plans are being developed for the parishes of Walkeringham and Misterton, adjoining the northern sections of the Trent within Bassetlaw.

- North East Lincolnshire- Further to the Planning Inspector Examination, Main modifications were made to the Local Plan and a public consultation on the Main Modifications is ongoing (October 2017); status- not adopted.
- West Lindsey District Council-Adopted Central Lincolnshire Local Plan (2012-2036)
- East Lindsey District Council- Following Submission and review, a Main Modifications draft of the Local Plan has now been prepared; status - not adopted.
- Adopted Selby District Council-Core Strategy Local Plan (2011-2017);
- Doncaster Metropolitan Borough Council- Local Plan is under production; submission is planned for Autumn 2017; status- not adopted.

All above mentioned local authorities have many Neighbourhood Development Plans or Neighbourhood Development Orders, both in draft format and some adopted. These Plans will be considered in the context of the Strategy to identify how they can complement each other as well as to capture potential conflicts. As the Strategy study area and flood cells are finalised, the SA will identify all relevant Neighbourhood Plans and consider them throughout the appraisal process.

3.5 Key messages

Key messages from the review of the national and local policies and plans that apply to the study area are:

- There are various flood risk management strategies for the study area, and themes of managing and responding to climate change throughout many policies and plans.
- The Environment Agency has a role to further the conservation and enhancement of natural beauty, and the conservation of flora, fauna and geological or physiographical features of special interest.
- The local authorities located within the study area also have a responsibility to the conservation of nature and heritage and have a role in the planning and management of land-use to meet current and future housing and economic growth demands. The Strategy options might be subject to these planning considerations.
- All local authorities incorporate flood risk management requirements for new development proposals, stated in their local plans or core strategy policies.
- Each of these local authorities propose spatial development areas and sites allocated for various land-use types, including residential and employment. In addition, some authorities also propose Area Action Plans for specific areas within their boundaries where masterplan development and supplementary planning policies might apply. See Appendix 1 for a brief review of relevant policies from the local plans and area action plans that the Strategy and the SA must take into consideration and Figure 7 in Appendix 2 for location of some of the proposed development areas.
- The Strategy should have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural, historic or engineering interest.
- The Strategy should have regard to the desirability of preserving public access to the beaches, accessible areas of the coast or foreshore and other places of natural beauty.
- The Strategy should take into account effects that proposals may have on the preservation of public access or on the beauty or amenity of any rural or urban area, or on any flora, fauna, features, buildings, sites or objects.
- The Strategy should take into account effects that proposals may have on access to rural settlements that in turn could have an effect on employment and/or accessing community amenities.
- The Strategy should have regard to the aspiration and the various growth plans the sub-region, including that of the Northern Powerhouse Strategy and of individual local authorities to promote a low carbon economy, to promote renewable resources and contribute to reducing carbon emissions.
- In general, there are other government bodies and partner bodies such as the Local Authorities, Natural England, Humber LEP, Greater Lincolnshire LEP, Sheffield City Region LEP, Internal Drainage Boards who share similar objectives around flood risk management, economic development and environmental management. Opportunities for joint working, including seeking funding, exist for the Strategy. It is worth noting that the consultation on this Scoping Report is part of the efforts to support joint-working.

4. Baseline Reporting – Social and Economic Factors

4.1 Population and human health

4.1.1 Population

Over 1.5 million people live in Humber sub-region, with two thirds of the population living in urban areas and a third in rural areas. The proportion of rural or urban nature of the populations greatly differs between the local authorities within the study area (Table 4.1). Key urban centres include Kingston upon Hull, Goole, Immingham, Barton-Upon-Humber and Cleethorpes. These locations are also major employment and growth centres, and are important for housing, industrial and port operations. Bassetlaw and East Riding of Yorkshire are predominantly rural in nature; these areas along with North Lincolnshire and North-East Lincolnshire contribute significantly to the agricultural economy, both regionally and nationally.

The most recent census data was analysed for current population information based on the local authority areas, but data for the 'Yorkshire and the Humber' and 'East Midlands' sub-regions[7] were reviewed for future projections.

Table 4.1 2011 Census population data for the study area

Local authority	Percentage rural population	Percentage urban population
East Riding of Yorkshire	43.9	56.1
City of Kingston upon Hull	0	100.0
North Lincolnshire	45.0	55.0
North East Lincolnshire	9.9	90.1
West Lindsey	76.1	23.9
East Lindsey	62.9	37.1
Bassetlaw District Council	42.2	57.8
Doncaster Metropolitan Borough	13.9	86.1
Selby	75.6	24.4

Note: Large Market Town Population has been classified as Urban Population

4.1.2 Demography

Age distribution appears to be similar across the local authorities within the study area (Table 4.2), with persons under 16 years ranging from 15% to 19%. The population over 65 years of age is lower in the urban settlements of Kingston upon Hull, Doncaster and Selby. The highest proportion of ageing population is at East Lindsey, followed by East Riding of Yorkshire.

[7] Although the sub-regions do not formally exist, statistics and projections issued by ONS have been used for information.

Table 4.2 Population-age distribution

Local authority name	% Persons under 16	% Persons 16-44	% Persons 45-64	% Persons 65 and over
Bassetlaw District Council	17.86	34.79	28.79	18.55
Doncaster Metropolitan Borough	19.01	37.39	26.69	16.91
City of Kingston upon Hull	18.86	43.19	24.01	13.94
East Riding of Yorkshire	16.71	32.14	29.77	21.38
North East Lincolnshire	18.94	36.70	26.63	17.72
North Lincolnshire	18.72	35.34	28.00	17.94
West Lindsey	17.36	31.45	30.31	20.87
East Lindsey	15.38	28.60	30.04	25.98
Selby	18.35	35.19	29.67	16.78

Population over the age of 65 is projected to grow at the fastest rate by comparison to other age groups across the whole of England. In the 'Yorkshire and The Humber' sub-region the growth will be slightly slower at 18.3% than the England average of 20.4%, whereas in the 'East Midlands' growth is projected to be 22.0%.

Population projections for the year 2024 (using a Mid-2014 ONS (Office for National Statistics, 2014) population estimates) for Yorkshire and The Humber sub-region indicate a 4.6% growth, 2.9% slower than projected national growth. The projected growth for East Midlands (is 6.7%, which is 0.8% slower than the national average. Of the local authorities in the study area, Selby is projected to have the highest population change by 7.3% (2014-2024) and Northeast Lincolnshire with the lowest at 1.1%. Although growth is projected to be slower than the national average there will be a need to make housing space for the growing population, both in the rural and urban areas of the study area and to consider the needs of the ageing population. A review of the relevant policies and development plans are discussed in section 3, Appendix 1 and subsequent sections.

4.1.3 Flood risk and human health

Currently, the homes of more than 400,000 people around the estuary are at risk of tidal flooding (including storm surges in the North Sea), and are protected to varying standards by existing flood defences. Most of these people are concentrated in the urban areas, with relatively fewer people living in the larger, rural expanse of the study area.

The health of people living with flooding and the fear of flooding can be affected in the short and long-term. In addition to the risk to life and physical injuries and restriction to health services, recent studies by Public Health England (2017) noted impacts of flooding and flooding-related disruption on mental health and wellbeing. This includes high levels of probable depression, anxiety and PTSD amongst those who had floodwater in their homes, but also elevated levels in those whose homes were not flooded but whose lives were otherwise disrupted. Amongst those whose homes were flooded a number of factors, which may reflect severity of flooding, were associated with a higher risk of poor mental health outcomes.

Future trend:

- The population is projected to grow in 'Yorkshire and The Humber', and 'East Midlands' sub-regions, albeit slower thank the national average, between years 2014 and 2024.
- Population aged 65 and over is predicted to grow at the fastest rate compared with other age groups in every region of England (2014 mid-year ONS estimates).

- Flood risk, and it's associated physical and mental health impacts on the communities at risk, is predicted to increase in future with climate change.

Strategic issues:

- Communities are at flood risk throughout the study area, with differing standards of protection from existing defences, with concentrated areas of people at risk in the urban centres, and relatively fewer people at risk in the larger expanses of rural areas.
- Government funding for flood risk management is traditionally focussed where most people can benefit. Alternative sources of funding or less traditional measures such as adaptation and community resilience may need to be considered for the less populated areas.
- The percentage of urban versus rural population is almost in equal proportion when considered across the whole study area and across North Lincolnshire, followed by approximately a 60/40 urban/rural split at East Riding Yorkshire and Bassetlaw. However, population density in urban areas is high implying more people at risk of flooding are concentrated in the urban centres, and those at risk in rural areas are spread out in the study area.
- Local authorities with a higher proportion of rural populations have a higher proportion of people over 65 years of age.

4.1.4 Social deprivation

Indices of Deprivation' is the official measure of deprivation in England and is a useful measure to help identify and evidence aspects of deprivation and social vulnerability in local areas. 'Indices of Multiple Deprivation' (IMD) consist of individual indices based on seven themes, or domains (with weightings in brackets): Income (22.5%), Employment (22.5%), Health and Disability (13.5%), Education, Skills and Training (13.5%), Barriers to Housing and Services (9.3%), Crime (9.3%) and Living Environment (9.3%). Analysis across individual domains help to better understand local level performance, however to inform the strategic nature of the SA, IMD is considered a good measure to present an overall picture of the state of the local area. For the purposes of this report, only the '10% Most Deprived Areas' and '20% Most Deprived Areas' were identified. See Figure 1 in Appendix 2 for the IMD map of the study area.

The urban centres of Hull, Grimsby, Immingham, Goole and Doncaster have populations living in the 10% and 20% Most Deprived Areas (GOV UK, 2015), and pockets in East Riding of Yorkshire, North Lincolnshire, and North-East Lincolnshire also host 10% and 20% Most Deprived Areas. Although East Lindsey and West Lindsey are reported to comprise many areas that also fall in the above category, they are not located within the study area boundary.

Future trend:

- The indices linked to IMD such as income and employment could be affected by the proposed economic growth plans in the region, depending on workforce skills. Similarly, a reduced risk of flooding could unlock opportunities that could be directly linked to the indices, for example Barriers to Housing and Services or Living Environment.

Strategic issues:

- The majority of the study area does not contain 10% or 20% Most Deprived Areas; however, where they are contained, they appear to be concentrated on few urban centres and towns where the majority of the study area's urban population reside and are at flood risk.

4.2 Access and recreation

Promoting sustainable development and green infrastructure links is a key overarching environmental goal in the Humber region. There are close links between access to community infrastructure, greenspaces, heritage assets, historic landscapes and local economic growth, community cohesion, leisure and recreation. It is in this context that this section discusses various access and recreation aspects in the study area.

Residents and visitors to the study area have formal access to the countryside and the coast via Public Rights of Way, National Cycle Routes, and National Trails (see Figure 2 in Appendix 2). This includes regional routes such as the Trans-Pennine Trail and the Viking Way. There is also informal access within the study area used for leisure or recreational purposes, including to the coast and estuary foreshore.

There is an ongoing proposal for the England Coast Path, a new National Trail around all of England's coast, due for completion in 2020[8]. This path is being developed by Natural England to comply with the Marine and Coastal Access Act. Within the study area, the proposed England Coast Path runs mainly along the edge of the estuary, with some inland diversions to avoid operational ports. The stretches encompassing the Humber Estuary start at Easington on the north bank, running westwards to Hessle, across the Humber Bridge and then eastwards along the south bank of Mablethorpe. The path will roll back in response to coastal erosion events or to reflect future changes to the coast due to managed realignment. The England Coast Path is designed to provide access on foot only. The route of the path and any restrictions applied to access will address impacts to the Humber Estuary designated site, alongside any mitigation measures that may be implemented. Of its many objectives, this Path is envisaged to adapt to the impacts of coastal erosion. The Coast Path is a pedestrian only path.

Based on the Natural England's Yorkshire and Humber Green Infrastructure Study (2010), the recent Humber Landscape and Green Infrastructure Study (Cambridge Studios (Sheils Flynn)), identified five strategic green infrastructure sites in the study area (see Figure 2 in Appendix 2 and section 5.4.3), with potential access and recreation uses for these. These are:

- Humber Bridge Hinterland – Wetlands, cycleways and Country Parks;
- Cleethorpes and Tetney – Eco-tourism and nature watching;
- Goole Hinterland – River views and farmland connections;
- Hull Waterfront – A string of destinations along the banks of the Humber; and
- Humber Estuary farmland – Options for dynamic flood management.

Further information on the Natural England Yorkshire and Humber Green Infrastructure Study and detailed description of green infrastructure within the study area can be found on their website9.

There are many recreation facilities and destinations within the study area (such as nature reserves, country parks, coastal paths, and seaside resorts - see section 4.3.3) where outdoor pursuits regularly take place, such as walking, cycling, bird-watching, horse-riding, fishing and water sports. Key visitor destination location was mapped as part of the Humber Integrated Landscape and Investment Study (Cambridge Studios (Sheils Flynn), unpublished) reproduced in Figure 3 of Appendix 2.

Angling is another recreation activity, with active participants along various parts of the study area, whose activity is dependent on physical access to fishing areas, water levels and water quality which in turn will influence fish availability. A few spots within the study area considered good for fishing are Spurn Head, Humber Estuary (East Halton Skitter, Hessle area near the Humber Bridge), North Wall of Grimsby Harbour, Barton Upon Humber and Cleethorpes promenade.

Future trend:

- Access to the coast is becoming more formalised, with sections of the study area proposed to be part of England Coast Path, a new National Trail.
- There is likely to be an increase in nature-based tourism and outdoor recreation, particularly with the growing interest in the region and new proposals, such as the England Coast Path.
- Strategy interventions should balance access and recreation with biodiversity considerations, as this will be crucial to complement the conservation objectives of biodiversity designations in the study area.

[8]England Coast Path, Natural England https://www.gov.uk/government/collections/england-coast-path-improving-public-access-to-the-coast (accessed 23.10.17)

[9] Natural England Green Infrastructure Mapping Project http://webarchive.nationalarchives.gov.uk/20140605112209/http://www.naturalengland.org.uk/regions/yorkshire_and_the_humber/ourwork/yandhgreeninfrastructuremappingproject.aspx

Strategic issues:

- The Humber area has numerous facilities and destinations for access and recreation, both inland and along the coast, and through formal and informal access. These might also house sensitive environmental features, such as nature conservation sites. Current networks of footpaths, bridleways and trails connect many of these destinations.
- Local communities may access inter-tidal or coastal areas to undertake traditional activities such as foraging - these may not always be formal access routes and are often facilitated by the presence of existing flood defences.
- Many parts of the study area offer excellent spots for angling and the sport is dependent on water levels and maintenance of access to designated fishing areas.
- Green Infrastructure in the study area has varied potential, ranging from leisure, nature-watching to flood management which the Strategy could consider exploring, providing the impact on environmental receptors are recognised and managed.
- Flood risk management measures may impact on formal or informal access to the estuary and this should be considered within the strategy development.

4.3 Economic activity

4.3.1 Key economic sectors

The key economic sectors in the Humber area can be classified as manufacturing, shipping and logistics, agriculture and fisheries. Manufacturing accounts for 17% of the employment, by comparison to the English average of 8% (ONS, n.d.).

The chemicals and petrochemicals industry contribute to the economy of the sub-region: about 25% of the liquid transport fuels of the country are refined in the Humber; and the Humber area hosts 20% of the UK's natural gas landings. The region holds an important position in terms of the presence of oil and natural gas as it benefits from the proximity to the Southern North Sea gas fields.

In recent years, the Humber Estuary has gained prominence and has positioned itself to becoming what is called the 'Energy Estuary' by securing major investments in wind energy from companies such as Dong Energy and Siemens. These investments created jobs in the area and are expected to generate further jobs, which will trigger further jobs through the supply chain. There are also investments in the education sector to promote offshore wind energy related education.

The Humber Estuary is also an important trade gateway with an average of 40,000 ship movements per year. The area contains the UK's largest ports complex and its ports and wharves handle 14% of the UK's international trade (Humber Nature Partnership website). The Humber's growth zones and corridors are centred on the major ports of Grimsby, Goole, Hull and Immingham. Port and port-related developments add value to the area's economy and they present significant economic development opportunity in the Humber, particularly in relation to the development of manufacturing and servicing facilities for the offshore wind industry.

See section 4.5.4 for more analysis on the rural economy, and Appendix 3-1 for detail on the employment by sector.

4.3.2 Economic indicators

Employment figures for the region, as of January 2017, indicates 73.5% of the working age population are in employment in the Yorkshire and the Humber region, which is below the national average. Unemployment rate was at 5% for the same period, slightly higher than the national average but had fallen by 1.2% in comparison with the year 2016 (ONS, n.d.).

Significant numbers of the local population are employed in the manufacturing, wholesale and retail trade sector, administrative and support services sector and the agriculture sector in comparison to the national average. Employment in the construction sector is almost on par with the national average. Analysis of workforce

employment across the sectors between 2015 and 2017 did not suggest major shifts across the sectors, although this trend may change with the proposed growth plans to move towards the renewable energy sector.

The Gross Value Added (GVA) measure provides a useful indication of the trajectory of the local economy and although there are technical issues with estimating GVA at the local and regional level, it is widely accepted as a key measure of overall economic activity that could provide an indication of how productively the economy is utilising its resources (including labour). Manufacturing contributes 27% of the GVA in the Humber. A study by Hull Business School commissioned by the Humber Local Enterprise Partnership (University of Hull, 2016) shows that the Humber is below the nation's average on key metrics such as economic prosperity, productivity, manufacturing output, value-added jobs, skills, employment and social mobility. The study stresses the need for action to reverse the trend in the region. Some of the recommendations are- to consolidate the Humber as the Energy Estuary (renewable energy generation and related manufacturing); to develop the port-based economy and to develop an integrated multi-modal freight and passenger Gateway; and to support/ develop other sectors such as chemicals and processing and information and communication. It is of note that although GVA continues to lag behind national levels, information available in 2016 suggests that this gap is closing between the Humber and the rest of England.

4.3.3 Tourism and recreation

The study area consists of many tourism attractions and destinations both along the coast and inland (see Figure 3 in Appendix 2). These range from outdoor attractions such as beaches, parks, and nature reserves, to urban centres, such as Goole, Kingston upon Hull, Barton-upon-Humber and Cleethorpes, and various museums, theatres, galleries, historic buildings, aquarium, and holiday parks for example. In addition, there are various gardens, including Registered Parks and Gardens and historic buildings, such as Brodsworth Hall in Doncaster and Selby Abbey in Selby. The Deep aquarium at Kingston upon Hull attracts visitors throughout the year. Many of the attractions provide educational resources for the local communities and visitors. These assets reflect the area and its diversity so would not be easily replaced elsewhere.

Visitor economy, which includes food and service management, gambling, hotels, bars, restaurants, holiday parks, private accommodation providers, tourist services and visitor attraction centres, employs about 14,000 people in the Yorkshire and the Humber region and contributes to 2.4% of the region's employment. In addition to the physical features, tourism has had a boost in terms of investments in recent years with Hull chosen to be the UK City of Culture 2017 and from other opportunities such as Water's Edge Country Park visitor's centre (which opened in 2006).

The England Coast Path, delivered by Natural England, will form a National Trail around the coast of England, with the aim of bringing economic and health benefits to both visitors and coastal communities. As nature tourism to the Humber increases, careful management will be utilised – both as a part of the formal coastal access proposals and through partnership working with local stakeholders and local access authorities in order to ensure that important estuarine habitats and species are protected.

The Humber Nature Partnership's Humber Recreation Management Plan (Humber Nature Partnership, 2016) proposes recreation management zones around the Humber Estuary and emphasises the need to balance tourisms economic potential with the impact on the many designated features in the study area.

Future trend:

- Ambitious economic growth activities are planned for the Humber sub-region whose aim is to make the region a leader in low carbon economy, take advantage of and develop its port-based economy, as well as the chemicals-processing and Information, Communications and Technology sectors.
- Tourism activities, including increased formal access to the coast, is expected to increase in the future. This could contribute to visitor economy, however needs to be balanced with protecting the designated features in the study area.

Strategic issues:

- The manufacturing, ports and logistics, and agriculture are key sectors of employment in the study area.

- Unemployment rates are higher than the national average but have fallen slightly between 2016 and 2017. Levels of income inequality and the costs of resource depletion are higher than national average.
- The Humber's countryside and the coast are a major draw for tourists and for the local population.

4.4 Economic growth and inward investment

4.4.1 Introduction

The study area has several areas for planned economic growth, indicated by strategic economic partnerships and development planned by the local authorities.

4.4.2 Strategic economic partnerships

The relevant Local Economic Partnerships (LEPs) are the Humber LEP, Sheffield City Region LEP, York, North Yorkshire and East Riding LEP, and Greater Lincolnshire LEPs (see 3.4). LEPs promote partnerships of business, education and local authorities that work to secure funding and develop projects ranging from infrastructure investment, flood defences, major housing development, rail electrification, road improvements, education facilities, city and town centre regeneration (namely Hull, Grimsby, Goole, Scunthorpe, Cleethorpes and Doncaster, West Lindsey, Lincolnshire Lakes in the study area). Local authorities, through their Local Plans or Core Strategies, propose land-use policies and spatial plans to enable economic growth and associated development such as housing, shopping and leisure.

The Humber LEP has proposed the Humber Enterprise Zone to boost economic growth in the Humber sub-region. There are more than 40 Enterprise Zones located in North Lincolnshire, East Riding, North East Lincolnshire and Hull, offering a total of up to 290 ha land, located close the four main ports, Goole, Grimsby, Hull and Immingham (see Figure 4 in Appendix 2).

Green Port Hull launched recently sets a vision to establish Hull and the East Riding of Yorkshire as world class centre for renewable energy. Hull City Council, East Riding Council, Associated British Ports and their partner organisations have secured Regional Growth Funding to support growth in the renewable energy sector (for opportunities in offshore wind, biofuels, waste to energy, solar, wave and tidal power generation) and contributing to future employment opportunities. ABLE Marine Energy Park is another significant project that will be a bespoke facility for the Renewable Energy Sector, particularly Offshore Wind and there are plans for this Energy Park to grow further (consented project). Humber is the last deep-water port in Europe for room for expansion.

Sheffield City Region LEP area covers Doncaster and Bassetlaw. The Sheffield City Region's Infrastructure Improvement Plan discusses schemes that the LEP will promote in order to support their economic growth plan ambitions. Of relevance to this study might be the DN7 Spatial Package where significant opportunity for growth in the low carbon sector through infrastructure provision for carbon capture, flood defence provision and connectivity improvement are identified as desirable infrastructure outcomes to support economic ambition.

The York, North Yorkshire and East Riding LEP which covers Selby and East Riding areas, also have ambitious economic growth plans and have allocated investments from their Local Growth Fund. Of relevance to Selby and East Riding parts of the study area is that these areas are identified for investments in road network and flood alleviation schemes to protect businesses and to unlock further development opportunities and to help create a resilient economy.

A summary of Sheffield City Region LEP is provided in Appendix 1 as the LEP area covers Doncaster and Bassetlaw. A review of the York, North Yorkshire and East Riding LEP, which covers East Riding of Yorkshire and Selby is also provided in the Appendix 1 and the review findings will be considered in the SA. Review of the Humber LEP is also provided in Appendix 1.

4.4.3 Spatial planning and development policies

All local authorities propose policies and plans to contribute to the achievement of sustainable development. The local authorities manage existing development proposals and allocate sites for future housing, employment

and other land uses such as retail, open spaces, and traveller sites through their Local Plans or Core Strategies policies, which in-turn will support the regional economic growth plans.

Some of these spatial plans are currently in consultation but are presented as draft in the review of the Local Plan and Core Strategy policies of all local authorities in the study area Appendix 1. Current employment sites are shown in Figure 5 and the locations of local authority proposal areas are shown in Figure 6 in Appendix 2.

Future trend:

- Should the vision for economic growth be realised, the Humber sub-region will become a leader in the low carbon economy, develop its port-based economy, as well as its chemicals-processing and ICT sectors.
- All relevant LEPs place emphasis on investing in many road improvements, along with rail line improvements and enabling multi-modal connectivity to boost the region's economy.
- Planning for new residential and associated developments will be critical in supporting the economic development plans for the sub-region.

Strategic issues:

- The Humber sub-region has several ambitious plans for economic growth through strategic economic partnerships and local authorities' spatial planning.
- The Strategy could have an influence on the viability of some of the proposed economic growth zones through the flood risk management solutions.

4.5 Rural land use and rural economy

4.5.1 Land use classification

Significant part of the study area falls within the 'predominantly rural' of 2011 Census Rural-Urban Classification, these include local authority areas of Bassetlaw, Doncaster, East Riding of York, East Lindsey, North Yorkshire County Council and North Lincolnshire. The majority of the study area is in agricultural use.

4.5.2 Farming

The total farmed area in the wider Yorkshire and Humber region is approximately 12% of the farmed land in England. The agriculture land classification information shows most of East Riding Yorkshire, North Lincolnshire Council and East Lindsey is composed of Grade 1 and Grade 2 Agricultural land, and the rest of the study area with Grade 3 to 5. See Figure 7 in Appendix 2 for distribution of the agricultural land classifications by local authority boundary.

Recognising the need to manage water pollution linked to agriculture and farming as well as to manage the landscape character, the Catchment Sensitive Farming scheme and Environmental Stewardship schemes are being progressed in the study area. The RSPB, in association with Environment Agency, is working with farmers in the Humber area to trial and disseminate information on flood management and adaptation techniques (such as temporary flood storage) to the benefit of farming (RSPB, 2016).

It is worth noting that many organisations, local communities and local businesses have come together to tackle environmental issues in the study area. An example is where the Humberhead Levels Partnership is helping to create a unique network of wetlands whilst supporting communities and wildlife through adopting sustainable land management practices[10].

4.5.3 Fisheries

The estuary is recognised as an area for many commercially important species: six species of fish are caught commercially (sole, plaice, roker, cod, dogfish, and eel), although commercial fisheries are small. The estuary also provides nursery grounds for commercially important North Sea fisheries.

[10] http://www.ywt.org.uk/what-we-do/creating-living-landscapes-and-living-seas/south/humberhead-levels-partnership

4.5.4 Rural economy

Almost 70% of Yorkshire and the Humber is farmland and is one of the UK's most important agricultural regions, producing 12% of England's agricultural output and employing 10% of the country's agricultural workforce. The region grows most of UK's important arable crops, and also grows energy crops and specialist oilseed and fibre crops (BioVale, n.d.). There are about 14, 000 people employed in the food and agriculture sector, including livestock farming in the Humber area accounting for 4.1% of employment in the Humber (LMI Humber, n.d.). Hull hosts the world's largest pea-processing plant.

Defra's aggregate agricultural accounts for Yorkshire and the Humber (and for a smaller part of the study area, East Midlands) were reviewed to gather information on the state of the agricultural economy in the study area. In 2015, predominant farm types were cereals, general cropping and livestock in both regions. The total income from farming has decreased between 2011 and 2015, reflecting on the national trend but the percentage decrease in the Yorkshire and the Humber region was lower than the national figure and was marginally higher than the average in the East Midlands.

Bioeconomy is an evolving concept and the Yorkshire and the Humber region already contributes to 10 % of the country's bioeconomy (BioVale, n.d.) including large scale industrial processes such as the production of biofuel at Saltend. The region is also seeing an increase in the diversification of farmland into agri-tourism. The nature of the countryside in the study area offers opportunities for nature tourism, which also has links to the access, recreation and landscape considerations of the Strategy.

Future trend:

- The Yorkshire and the Humber region accounts for 10% of the nation's bioeconomy and with the global move towards concepts of circular economy, this trend is likely to continue, dependent on government commitment and market take up.
- Large expanses of farmland will be subject to greater risk of flooding with climate change, if the risk is not addressed.

Strategic issues:

- The impact of the Strategy options on high value agricultural land (grades 1 and 2) and commercial fisheries must be considered in the SA.
- Agricultural areas that are less populated are typically less attractive to government funding for flood risk management than more populated areas, but may also provide the space for the flood risk management solution (such as flood storage or managed realignment) and opportunity for farming to adopt environmental stewardship practices.

Agricultural land management, agricultural landscape, flooding, habitats and wildlife and water pollution are inter-related, which is being recognised within the study area. This has led to initiatives such as Humberhead Levels Partnerships and Catchment Sensitive Farming schemes. These existing networks could help to explore opportunities to manage flood risk in the study area.

4.6 Material assets

4.6.1 Critical infrastructure

For the purposes of the Humber 2100+ Strategy, it is proposed to use critical infrastructure definitions relating to Categories 3, 4 and 5[11] of the Criticality Scale for national infrastructure (see CIRIA Guide - Flood resilience and resistance for critical infrastructure- C688) (CIRIA, 2010). A Critical Infrastructure Study, which will form part of evidence base to the Strategy development will be undertaken at a later stage and it is envisaged that this

[11] CAT 5- The loss of infrastructure that would have a catastrophic effect on the UK. These assets will be of unique national importance and their loss would have national long-term effects and may affect several sectors. Relatively few are expected to meet the Cat 5 criteria.
CAT 4- Infrastructure of the highest importance to the sectors should fall within this category. The effect of loss of these assets on essential services would be severe and may affect provision of essential services across the UK to millions of citizens.
CAT 3- Infrastructures of substantial importance to the sectors and the delivery of essential services, the loss of which could affect a large geographic region or many hundreds of thousands of people.

study will inform future SA stages to identify impact. At this stage, based on available information, critical infrastructure is identified below relating to transport and hospitals, power stations and utilities, and will be refined at a later stage in the project.

Transport

Roads play an important role in connecting the ports, such as Immingham, Grimsby, Hull and Goole and the many wharves located in the study area. Broad road corridors that have a key role in economic growth and serving as a link between the ports and areas inland are the A63/M62 road on the north bank and the A180/M180 road in the south bank area. The iconic Humber Bridge forms a major link between the north and the south bank of the estuary.

A significant part of the study area is rural in nature and there is evidence to suggest that there is a high level of car dependence particularly in rural areas, both for economic and social purposes.

Passenger and freight rail networks connect Hull with Selby and Goole and further west and to the north of the study area; similarly, the key economic growth areas of Grimsby, Immingham, Barton upon Humber and Cleethorpes are connected to the west to Scunthorpe, Doncaster and beyond.

Goole also provides a key interface between rail, road, the Humber Estuary and the inland waterway network west to Leeds. The Goole Intermodel Project, which has received LEP endorsement, will help to facilitate a greater use of inland waterway.

As described in Section 4.4.1, the Humber Estuary is also an important trade gateway with an average of 40,000 ship movements per year. The area contains the UK's largest ports complex and its ports and wharves handle 14% of the UK's international trade (Humber Nature Partnership website). Port and port-related developments add value to the Humber area economy directly as well as indirectly in supporting the development of manufacturing and servicing facilities for the offshore wind industry and other industries.

Hospitals, power stations and utilities

The following are known critical infrastructure features that are located within the study area, gathered using open source data; with modelling data analysis due to be conducted as part of the Strategy, we will determine whether these features are at risk.

- Hospitals - Hull Royal Infirmary and Goole and District Hospital;
- Power stations - Immingham, Salt End, South Humber Bank and Drax (Selby); and
- Various petro-chemical and gas terminal transfer facilities including gas transmission pipelines.

There are likely to be emergency service assets, National Grid Power Sub-stations and linked assets, water and waste water treatment assets and schools and universities that fall within the study area boundary and which may be at risk of flooding. Humber is the landing area for a large amount of offshore wind, which is another potential source of power that is a key driver for economic growth in the area. Further stages will explore ways to gather this data, including reference to a proposed critical infrastructure study to inform the Strategy.

See Figure 8 in Appendix 2 for the strategic road, rail network with location of ports and known infrastructure within the study area. Further information, if received as part of this consultation, will be used to update this section for future SA stages.

4.6.2 Mineral sites

The Joint Minerals Plan Kingston Upon Hull & East Riding of Yorkshire (Hull City Council & East Riding of Yorkshire , 2004) reports that the joint area has significant deposits of a wide range of minerals. Its simplified geology map indicates deposits for the whole of Kingston upon Hull and eastern section of East Riding of Yorkshire composed of salt, central section of East Riding of Yorkshire composed of crushed rock and some sections of the western side of East Riding of Yorkshire composed of sand and gravel. Other minerals include chalk, clay, silica sand and peat. There are also potential resources of oil, gas and coal, and for underground storage of gas. The Joint Minerals Plan is currently being revised and expected to be adopted late 2017.

Also, the Humber Estuary includes one of the six main dredging areas off the coasts of England, which produces marine dredged aggregates (mixture of gravels, sandy gravels and gravelly sands, and sand banks) (Atkins, 2010).

North Lincolnshire Council are preparing a Minerals and Waste Development Plan document (Issues and Options), and are working on evidence base, for example, the draft Humber area Local Aggregates Assessment (commissioned by North East Lincolnshire, East Riding of Yorkshire and Kingston upon Hull Councils). In the absence of a Minerals and Waste Development Plan, the strategic minerals policy in the Core Strategy of North Lincolnshire Council (North Lincolnshire Council, 2011) will apply in the interim.

A plan showing mineral extraction zones and some areas safeguarded for possible future mineral extraction in the study area, and is shown in Figure 9 in Appendix 2.

Nottinghamshire County Council is currently in the process of preparing a new Minerals Local Plan, which when adopted will replace the current Mineral Local Plan. The Issues and Options consultation of the new plan is ongoing. When mineral sites and safeguarded sites information are updated as part of the new plan, this baseline chapter and Figure 9 in Appendix 2 will be updated (providing the new plan is complete before finalising the Strategy).

The study area hosts chemicals and petrochemicals and oil refineries that supplies significant resources to the rest of the country, hence an important mineral resource. Most of the study area is covered by onshore oil extraction licence which only indicates potential and not necessarily that oil is being or will be extracted from these locations. However, from the Strategy perspective, this information may be relevant when considering location specific options.

Future trend:

- The study area includes areas safeguarded areas for future mineral extraction. East Riding of Yorkshire's salt resources are limited - once mined they could be a suitable location for underground storage of gas.

Strategic issues:

- The Humber Estuary's critical infrastructure is important for the region's economy, especially the strategic road and rail networks and the ports, and for serving the local communities. Protecting these critical infrastructure assets from the risk of flooding will be crucial in advancing the planned economic growth of the region. The Strategy should seek to align with the strategic plans of Highways England, Network Rail, National Grid, the Humber LEP and other national or regional agencies.
- The study area comprises varied types of mineral resources. Mineral working can have positive or detrimental effects in managing flood risk. Strategy development should consider direct and cumulative impacts on minerals safeguarded areas, if any are near proposed option sites.

5. Baseline Report – Environmental Factors

5.1 Biodiversity

5.1.1 Statutory designated features

The Humber Estuary is a large, muddy, macrotidal estuary, providing a highly productive ecosystem that supports a wide range of habitats and species. The estuary has component intertidal and subtidal habitats (mudflats, sandflats and saltmarsh) and associated saline lagoons, sand dunes and standing waters. The assemblage of breeding birds is of importance, and the wildfowl and wader numbers can rise as high as 200,000 during winter months. The estuary also supports various mammals, fish, invertebrates and plants, some of which are rare or threatened, including Natterjack toads (*Epidalea calamita*), grey seals (*Halichoerus grypus)*, river lamprey (*Lampetra fluviatilis)* and sea lamprey (*Petromyzon marinus)*.

The Humber Estuary is recognised as one of the most important estuaries in Europe for nature conservation and is protected by multiple international nature conservation designations: the Humber Estuary Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar Site. The Estuary also has national designations: Sites of Specific Scientific Interest (SSSI), and National Nature Reserves (NNR); and local designations such as Local Nature Reserves (LNRs). Some designations overlap the same areas, such as the Humber Estuary intertidal and subtidal areas are designated as SAC, SPA, SSSI and other designations.

The Humber Estuary supports a diverse fish community including resident, marine migrant, nursery-using and over-wintering species and those taking migratory route through the estuary. Over 85 species of fish have been identified in the estuary. Improvements in water quality in the inner estuary, and the lower reaches of the River Ouse, have led to the return of migratory fish species like salmon and trout.

Further inland in the study area, are additional SACs, SSSIs, NNRs and LNRs. These include, for example, the SAC, SPA and SSSI on the River Derwent and lower Derwent valley, which are considered to represent one of the best British examples of the classic river profile, supports plants uncommon to northern Britain in its floodplain meadows, rare fish species and otter (*Lutra lutra*), and a diverse assemblage of breeding and wintering waterfowl.

Another example are the species-rich meadows in the Aire floodplain (Eskamhorn Meadows SSSI) that would have traditionally been seasonally flooded.

Further information on the designated sites and their status is provided in Appendix 3 and the designations are shown in Figure 10 in Appendix 2.

Biodiversity in the study area, including the designated sites, has been historically under pressure from built development and agricultural intervention. In recent years many agri-environment schemes and evidence studies such as the Humber Green Mapping Project (Natural England) have been undertaken to manage the pressure on biodiversity and improve understanding to integrate land-use and economic development with nature conservation.

As part of the previous Strategy, commitments were agreed through the HRA to delivering a programme of habitat creation projects to compensate for effects on the Humber Estuary SAC, SPA and Ramsar site. As part of the Humber 2100+ development, the 'balance of habitat losses and gains will be reviewed and modified to meet the future compensatory habitat needs. Any compensatory habitat schemes in development anticipated to be completed by 2021 (starting period for the new Strategy) will be considered to form part of the SA baseline.

5.1.2 Non-statutory designated features

Biodiversity interests extend beyond the statutory designated sites into the countryside and within the built-up areas around the Humber. These include county wildlife sites, local wildlife sites, Sites of Importance for Nature Conservation (SINCs), Wildlife Trust nature reserves, community forests, other nature reserves, wildlife corridors and various habitats of principal importance for the conservation of biodiversity are listed in section 41 of the

NERC Act. Such features are also of amenity value for local communities. Some of these features are given in Figure 11 in Appendix 2.

For example, there are four RSPB reserves within the study area including Read's Island, which is important for supporting breeding avocets, and Blacktoft Sands, which has the largest area of tidal reedbed in England. To enable flood risk management activities around the estuary and meet UK legislation, the Environment Agency has created areas of new estuarine habitat through the managed realignment of existing tidal defences, such as at Paull Holme Strays (which is managed by Yorkshire Wildlife Trust) and Alkborough (which was also designed to store flood water). Much of the East Riding of Yorkshire and Kingston upon Hull area are covered by the Heywood Community Forest. Local community involvement is likely to be high on these sites and must be understood if these areas coincide with Humber 2100+ Strategy proposals.

In addition, Natura 2000 site habitat compensation areas that have been secured as part of development consent requirements for development projects in North East Lincolnshire, North Yorkshire and East Riding Yorkshire Council areas will also be considered in this Humber 2100+ as planning policy emphasises the need to consider them part of the designated site, indicated in Figure 11 in Appendix 2. These sites will be considered in the HRA, whose findings will feed into the SA in the later stages.

Other notable biodiversity present in the study area includes protected species and farmland bird populations. Farmland bird populations within the Humber area are considered important due to declines in populations elsewhere in the UK (as reported by the British Trust for Ornithology (Nov 2017)).

Peat is found in large deposits to the west of the Trent Valley and south of the River Ouse, such as on Goole Moors, Crowle Moors and the Isle of Axholme (some of which forms part of the Humberhead Peatlands NNR and associated SSSIs). Smaller deposits are found in the East Riding to the north of Newport/Gilberdyke in the Hotham Carrs area (Joint Councils, 2013).

Future trend:

- Predictions for sea level rise and foreshore erosion due to climate change will result in the loss of intertidal habitats ('coastal squeeze'). The previous Strategy estimated the coastal squeeze losses to be approximately 600 ha between 2000 and 2050 (this estimate will be updated as part of the Humber 2100+).
- Climate change and associated sea level rise pose continuing and new challenges to the management of all designated sites, habitats and species.
- Complex changes in bird populations and migratory patterns are taking place on a regional and global scale, and this is thought to be linked to climate and habitat change. The bird populations around the Humber are reported to have been declining in recent years and this may continue or may be part of a cycle.
- Predicted population growth, plans for growth such as around the ports-based economy, developments, increased formal access to the coast, and interest in nature tourism could put further pressure on biodiversity and future sites for habitat creation.

Strategic issues:

- The study area is of considerable importance for nature conservation, comprising many international, national and local statutory designated sites as well as non-statutory sites, and habitats and species, some of which are rare or threatened.
- Historically, the biodiversity of the Humber Estuary has been threatened and directly impacted by both urbanisation and agricultural intensification. The freshwater and wet grassland habitats are a particularly limited and threatened resource. Overall, the bird populations appear to be in decline - the reason for which is not well understood.
- Maintaining the defences in their current alignment will result in further coastal squeeze of SPA/SAC habitat, and along with any direct habitat losses from proposals, will require 'mitigation' and/ or 'compensation' for these losses.
- The Humber 2100+ Strategy presents opportunities for a co-ordinated approach between identifying opportunities for creation and delivery of priority habitats and flood risk management; for improving the

conservation status of designated sites; and for strengthening habitat networks, providing corridors and creating stepping stones which will increase resilience to climate change by reducing fragmentation and enabling species movement.

- Peat is linked to carbon sequestration - the potential impact of the Strategy on peatlands must be taken into account.
- The study area also includes non-statutory nature conservation sites, where local community involvement is likely to be important and must be understood if these areas coincide with Strategy proposals.

5.2 Water

5.2.1 Introduction

The study area comprises of a complex hydrological system with interconnected rivers, the estuary, ditches, canals, lakes/ponds and groundwater bodies. Ongoing economic activities, including industry and agriculture are both dependent on these systems and have an influence on the waterbodies, such as the way they flow and their quality. Flood risk management activities also have an impact on the hydrological system which must be understood as far as possible and considered by the Humber 2100+ Strategy.

5.2.2 Waterbodies

The Humber Estuary is one of the North Sea's principle estuaries, with a catchment approximately one fifth of the land area of England. The Humber Estuary and its principal tributaries, the rivers Trent, Ouse, Ancholme and Hull form the largest catchment area of any river system in England. See Figure 12 in Appendix 2 for the primary river network.

Water bodies are classified under the Water Framework Directive (WFD) (2000/60/EC) [12] and given a status according to their ecological/biological, hydromorphological and chemical characteristics. Several surface water bodies in the study area are classified under WFD: the Humber is classed as a 'Heavily Modified Transitional' water body (divided into Upper, Middle and Lower reaches); the Ouse and Derwent within the study area are 'Heavily Modified', and the Trent within the study area is an 'Artificial'. All these water bodies currently have overall 'Moderate' status according to the River Basin Management Plan (RBMP) (Environment Agency, 2015). Nine classified ground waterbodies fall within the study area, such as the Grimsby Ancholme Louth chalk unit; East Riding mercia mudstone; and Aire and Don Sherwood sandstone. All waterbodies have good and poor status for various elements.

For detailed information on these WFD classified water bodies, see Appendix 3.

Additionally, a network of drains crosses the study area, draining large areas of farmland. The small internal drains feed into large soke dykes located directly behind the existing flood embankments beside the estuary. The soke dykes are predominantly freshwater but collect any seepage of estuarine water through the banks or overtopped flood water. Water from land drainage and from overtopping is largely discharged to the estuary through pumping stations and passive outfalls fitted with tidal exclusion doors or flaps. Larger tributaries such as the New River Ancholme discharge through sluice gates or similar structures.

5.2.3 Water quality

Water quality within the Humber Estuary is largely dependent on the input from effluent treatment plants on its banks and from the densely populated and industrialised parts of the inland catchment (Black and Veatch 2004). Water quality throughout the catchment has improved over recent decades, associated with the decline in polluting industries in the catchment, and more stringent controls on the release of pollutants. This has resulted in an increase in numbers of migratory fish (i.e. salmon and trout) in the estuary.

The estuary does not show any symptoms of eutrophication and is unlikely to become eutrophic as organic inputs to the estuary are declining (Boyes & Elliot, 2006) The trend is likely to continue because of the primary

[12] Water Framework Directive (Directive 2000/60/EC), implemented in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations (SI 3242/2003).

and secondary treatment of sewage entering the estuary. Periodically, a temporary reduction in dissolved oxygen (DO) (a 'sag') occurs in the mid-upper estuary when higher than average summer temperatures and low fluvial flows occur. Sediment transport and concentrations of suspended sediments have the potential to affect water quality (see section 5.2.3). Ongoing investigations into Dissolved Oxygen issues relating to abstraction and reduced flows are known at the time of writing this report and may be referred to when location specific options are developed as part of the Strategy.

A Nitrate Vulnerability Zone (NVZ) covers most of the study area, possibly due to the predominant agricultural land use, which is a designated under EC Nitrate Directive (91/676/EEC) (European Commission, 1991) where nitrate concentrations in sources of public drinking water exceed, or are likely to exceed, the EC limit of 50mg/l. See Figure 13 in Appendix 2.

Groundwater is important for maintaining river flows and water quality. Source Protection Zones (SPZ) are designated where the risk of contamination might cause pollution of important ground water bodies. Generally, the closer the activity is to groundwater source, then the greater the risk to groundwater. Three areas of the study area have GSPZs: in East Riding of Yorkshire (northern part of the study area) and North Lincolnshire and Northeast Lincolnshire near places such as Barton-upon-Humber, Goole, Immingham and Cleethorpes. There might be other areas that are vulnerable to pollution but not designated. Where this information is available and appropriate for strategic level, it will be considered in the SA.

The study area also has number of designated Groundwater and Drinking Water Safeguard Zones (SGZ) to manage nitrate concentrations in groundwater. These are areas where drinking water supplies are at risk of deterioration due to the use of substances like pesticides or nitrates. The Environment Agency works in partnership with Water Companies and Natural England to encourage farmers and land managers to make voluntary changes which will reduce nitrate pollution. Risks of saline intrusion is also noted in the study area, particularly for the Hull and East Riding Chalk Groundwater Body which is currently at Poor status for saline intrusion.

Catchment Partnerships or a Catchment-Based Approach (CaBA) has been developed around the country which takes a holistic approach to managing river catchments. This is a collaborative working arrangement between non-government organisations, Water Companies, Local Authorities, Government Agencies, Landowners, Angling Clubs, Farmer Representative Bodies, academia and local businesses to deliver cross-cutting improvements to the water environment. Within the study area there are many catchment partnerships, including Humber Catchment Partnership which deliver variety of activities whose outcomes include, addressing diffuse/ point pollution, flooding, restoration (ecology), engagement or recreation or improving fish migration. The Catchment Partnerships can help manage flood risk, especially through natural flood risk management.

5.2.4 Water resources

The whole study area is dotted with numerous water abstraction licences, ranging from small to large abstractions for tidal, surface and ground water, contributing to the drinking water supply as well as industrial uses in the Humber area and around the country. In the outer part of the Humber Estuary, large licensed tidal abstractions are located near Kingston upon Hull and near Immingham Docks, possibly to supply to power stations and the port areas, and others are located in the inner estuary. Also, the whole of the hinterland is scattered with groundwater and surface water abstraction licences[13].

The entire water supply for Hull City comes from the groundwater catchment zone of the Humber Estuary. Part of the Selby Wellfield public water supply abstractions fall within the SPZ, highlighting the need to consider the close link between water resources and pollution.

[13] Environment Agency water abstraction licences map: http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=water_abstractions&layerGroups=default&lang=_e&ep=map&scale=6&x=524133.33333333185&y=415259.4270833337#x=490146&y=408911&lg=1,2,3,6,10,&scale=5 (accessed 02.10.17)

Future trends:

- Predicted climatic changes combined with the anticipated population growth in the study area will put additional pressures on the water environment, potentially affecting drinking water supplies, wildlife, and industries in future.
- Climate change predictions show that temperatures will continue to rise, winter rainfall will increase, more rain will fall in intense storms and sea level rise will continue (Environment Agency, 2015). This is predicted to result in increased flooding and foreshore erosion, which without coordinated FRM activities, would lead to the existing defences being breached or overtopped and the large low-lying areas behind the defences being inundated more frequently.
- Current passive outfalls will be impacted by sea level rise on low water, for example, compromising ability to drain land for agriculture and potential impacting on third party infrastructure.
- Climate change predictions also indicate an increase in seasonal variation (Environment Agency, 2015) in flows (less in summer, more in winter), with a reduction in flow overall. Consequently, there will be less water available for abstraction and supporting wildlife (Environment Agency 2015).
- Predicted population growth and changes in rainfall patterns have the potential to increase pollution entering waterbodies. In urban areas there will be increased pressure on the sewer network due to increasing stormwater overflows and surface water runoff. Flooding of contaminated land would also increase pollution risk. In rural areas, intense rainfall is likely to exacerbate erosion and sediment runoff. Flooding of agricultural land is also likely to lead to increased pollution from fertilisers, herbicides and pesticides.
- With the increase in population and plans for economic growth, new developments around the estuary, such as housing developments, port expansions and industries, could also increase the demand for abstraction and physical modifications to the water environment.

Strategic Issues:

- All of the water bodies within the study area are classified as Heavily Modified or Artificial water bodies and have a Moderate status (in relation to the Water Framework Directive), implying that, with appropriate mitigation, they could be improved to achieve a Good Ecological Potential status. The Strategy must aim to prevent deterioration of the WFD status of surface waters and groundwater, and consider opportunities to include relevant mitigation measures to help achieve Good status, such as:
- **Flood protection measures:** avoid or reduce the impacts of physical modifications of the waterbodies, remove obsolete structures, realign flood defences, soften and rehabilitate banks, and encourage habitat preservation and restoration, enable fish passage.
- **Operations and maintenance**: sediment management regimes; retain and enhance habitats.
- **Habitat creation:** intertidal habitat creation; bank improvement; 'Green Infrastructure' and other types of habitat creation.
- The study area has several NVZs, SGZs and GSPZs, indicating areas to protect from pollution, and many water abstraction sources to be aware of when developing Strategy options.
- Encourage the creation and management of permanent grass field margins and buffers to watercourses, thus reducing nutrient and sediment run-off, and protecting key sewerage infrastructure from flood risk.
- Conserve the network of watercourses, ponds/lakes, drains, ditches and dykes and manage their habitats to improve biodiversity and value as landscape features.

5.3 Geomorphology

5.3.1 Overall morphological form

The Humber is one of the largest estuaries in the UK with a catchment an area of around 24,500km^2 (Edwards and Winn, 2006). The estuary decreases in width upstream from its mouth where it is around 15km wide. The mouth itself is constrained by a spit, Spurn Point, whose existence is partly dependant on underlying geology.

The previous estuary strategy and shoreline management plan divided the Humber Estuary into three regions with differing in geomorphology characteristics:

- **The Inner Humber - Trent Falls to the Humber Bridge.** This region is characterised by extensive intertidal sand/mud banks including Redcliff, Middle Sand, Winteringham, Barton Ness Sand and Hessle. This is the most dynamic region with significant lateral movements in channel positions.
- **The Middle Humber - Humber Bridge to Grimsby.** In this region, the main estuary channels generally have a stable configuration, with a dominant northern channel and an ephemeral channel along the southern shore. The Halton Middle channel forms the main channel.
- **The Outer Humber - Grimsby to Spurn Point.** This region shows increased movements of channels and banks. It has a 'three channel' system (the Haile, Bull and Hawke channels) with the Hawke Channel artificially extending across Middle Shoal as the Sunk Dredged Channel.

The Humber includes extensive intertidal areas (http://www.estuary-guide.net) composed mainly of mudflats and saltmarshes. These areas are important in terms of habitats and the birds that they support. Prior to the construction of defences around the estuary, much of the present-day flood plain of the estuary would have been intertidal marshes and mudflats.

5.3.2 Physical processes

Over the last 4000 years, sea levels have been rising relative to land levels at an average rate of about 1 mm per year. The relative rate of rise over the last 100 years has been between 2 and 2.5 mm per year. Present rate of sea level rise is superimposed on a number of cyclical changes, one of which (the lunar nodal tidal cycle) has a period of some 18 years and a maximum amplitude of about 50 mm (Environment Agency, 2000).

Superimposed on top of sea level rise are the main physical processes of waves, tides and freshwater flows. Additionally, low pressure atmospheric systems associated with high wind speeds can cause storm surges which can raise water levels up to 3 m above normal levels (Environment Agency, 2000). The importance of the various processes varies along the estuary, with wave processes generally being more important in the outer estuary and freshwater flows being more important in the inner estuary. Waves up to 4 m high can occur in the outer estuary between Cleethorpes and Donna Nook on the south bank and near Hawkins Point on the north bank, but reduce to little more than 1 m high upstream of Hull (Environment Agency, 2000). Tidal heights increase up estuary and on mean spring tides high water increases from 3.8m ODN at Spurn Head, to 5.2m at Owston Ferry in the River Trent and 5.3m ODN at Goole in the River Ouse.

Although the tidal limits extend into the tributaries, the Humber Estuary is often defined as extending from its mouth to the confluence of the River Trent and River Ouse at Trent Falls – a distance of 62km. The tidal influence extents a further 62km up the River Ouse to Naburn Weir near York, and 72km up the River Trent to Cromwell Weir at Gainsborough. Other significant tributaries to the Humber include Aire, Don and Hull.

Suspended sediment levels are high throughout the estuary (JBA Consulting, 2011). The high concentrations of suspended sediment are derived from a variety of sources, but fine sediment eroded from boulder clay cliffs on the Holderness coast are the most significant. Suspended sediment concentrations in the Inner and Middle part of the estuary are generally more than 200 mg/l (Boyes & Elliot) although higher concentrations (over 20 g l^{-1}) can occur in the turbidity maxima (Edwards and Winn, 2006; Uncles et al, 2006a; Uncles et al, 2006b). Suspended sediment concentrations are lower in the Outer Estuary (Boyes & Elliot, 2006). The position of the turbidity maximum varies seasonally, being further downstream during periods of higher freshwater flow (Mitchell *et al.*, 2012).

Future trends:

Evolution of the estuary- or uncertainties/unpredictability

- Predicting the future evolution of an estuary such as the Humber is subject to large uncertainties arising from a number of sources, including: (i) the driving forces (e.g. sea level rise, sediment supply, channel movement); (ii) anthropogenic influences (e.g. dredging, reclamation) and (iii) the estuary responses (e.g. erosion/accretion).

- The previous Humber Estuary Strategy estimated losses of habitat as 600 ha between year 2000 and 2050. These losses were all termed 'coastal squeeze' and assumed to be connected in some way with flood defences around the estuary. More recently, studies have illustrated that there are numerous causes for habitat loss in estuary environments as well as the influence of coastal defences.
- Work is currently being considered to look more closely at the actual losses of habitat in the Humber over the last 25 years to make a better assessment of the future losses associated with flood defences.

Strategic issues:

- Aim to prevent deterioration of the WFD status of the waterbodies, and consider opportunities to include relevant mitigation measures.
- Seek opportunities for enabling natural coastal and estuarine processes to continue, to benefit geomorphology and allow habitats to respond to the constantly changing patterns of accretion and erosion.
- Seek opportunities to increase the extent of intertidal habitats (saltmarsh, reedbeds and mudflats) to provide effective defence against wave energy and to support biodiversity.

5.4 Landscape

5.4.1 Landscape character

The Humber Estuary is the most significant component of the regional landscape – it has a unifying presence and is a focus for settlement, communication routes and the economy. It is a low-lying estuarine landscape with open and expansive waters, and vast intertidal habitats. Much of the adjacent land has been reclaimed and the wider area includes flat, low-lying, large scale agricultural landscapes bound by diverse topography. Several major rivers and a network of drainage ditches flow across the area. There is very little woodland in the rural areas so the ditches form important networks for linking the few other semi-natural habitats.

There are strong contrasts within this landscape. Much of it is open and expansive, with long views and tranquil and remote places, such as Spurn Point, Blacktoft and Skitter Ness, or quiet rural areas dominated by farming. The open landscape is broken up by urban infrastructure, isolated developments, large towns such as Hull and Immingham, and industrial complexes.

The landscape in the study area is characterised by 11 National Character Areas (NCA)[14]: Central Lincolnshire Vale; Lincolnshire Wolds; Holderness; Northern Lincolnshire Edge with Coversands; Humber Estuary; Humberhead Levels; Lincolnshire Coast and Marshes; Lincolnshire Wolds; Vale of York; Spurn Heritage Coast; and Yorkshire Wolds. In addition, four local authorities have adopted their own Local Landscape Character Areas following the production of their individual Landscape Character Assessments (LCAs), which provide further information on the local characteristics. The East Riding of Yorkshire Council have recently begun the process of preparing a new LCA.

Maps and further details of the National Character Areas and Local Landscape Character Areas are provided in Figure 14 in Appendix 2 and Appendix 3, respectively.

5.4.2 Landscape designations

The study area hosts the Spurn Heritage Coast, also known as Spurn Head Hook, located within East Riding of Yorkshire. This is a 5 km long sand and shingle spit arcing into the mouth of the Humber River which is constantly reshaped by coastal drift and maintained by the deposition of soft sediments from the coastline to the north. Heritage Coast is a non-statutory designation between the local authority and Natural England to protect coastlines of special scenic and environmental value from undesirable development. The coast is a stopover point for thousands of migrating birds in the spring and autumn and is also a Yorkshire Wildlife Trust Nature Reserve.

[14] Natural England's National Character Areas: http://publications.naturalengland.org.uk/category/587130 (accessed 02.10.17)

No other landscape designations are found within the study area, but the Lincolnshire Wolds, to the south of the study area, is designated as an Area of Outstanding Natural Beauty (AONB) on account of its high scenic beauty.

5.4.3 Other studies

In addition to Natural England's green infrastructure studies described in section 4.2, recent studies were completed on landscape and green infrastructure that could be delivered through FRM in the Humber Estuary, including the Humber Estuary and Green Infrastructure Study Report (Cambridge Studios (Sheils Flynn)). This report focussed on five strategic areas (for the Humber Bridge, Cleethorpes and Tetney, Goole, Hull waterfront, and Humber Estuary farmland) and developed a suite of localised studies around the whole estuary, characterising the local landscapes, investigating partnership investment opportunities and developing a suite of conceptual landscape designs.

Some of the agri-environment schemes around the study area, described in section 4.5.2, integrate opportunities for protecting and enhancing the local landscape.

Future trend:

- Predicted sea level rise due to climate change would lead to the existing defences being breached or overtopped and the large low-lying areas behind the defences being inundated more frequently, and to the erosion and loss of intertidal areas against existing defences.
- Potentially there could be pressure on landscape character from the predicted increase in population and planned economic growth and development around the estuary in the future.

Strategic issues:

- Much of the landscape character is open and expansive, dominated by the Humber Estuary, with long views and tranquil and remote places, such as Spurn Heritage Coast, or quiet low-lying rural areas dominated by farming and managed with a network of ditches such as along the banks of the Don, Ouse and Aire. This is in contrast with the large towns and industrial complexes, such as at Hull and Immingham. Maintaining the character while adopting changes relating to development remains a challenge and presents opportunities.
- Recent landscape and green infrastructure studies for the Humber Estuary highlight the potential for flood risk management projects to deliver creative opportunities that benefit users, landscape, landscape character and green infrastructure through dynamic partnership-working with stakeholders.
- Local communities are involved in many integrated landscape and agri-environment schemes who may be considered as potential stakeholders whilst developing the Strategy in specific locations where landscape is valued.

5.5 Cultural heritage and archaeology

5.5.1 Historical overview

The study area's prehistoric landscape was part of the Doggerland, the land bridge connecting Britain to Europe when a warming climate after the last major ice age exposed a continental shelf. Humans inhabited this historic landscape, which comprised of coastlines and dunes with extensive marshlands and grazed wet grassland. With further warming and rising seas, the land bridge was flooded and the island of Britain was formed. The dramatic changes in the Humber landscapes over history from climatic changes and the loss of diverse landscapes from land use practices over time provide the long-term context for flood risk management strategies and plans for sustainable development.

The Estuary and its floodplain contain a complex array of historic buildings, settlements, landscapes and archaeological sites that are a fundamental component of the regional identity. Archaeological evidence shows it has been a key trade and communications route since prehistoric times.

As the northern frontier of the Roman Empire, several Romano-British settlements were established in the study area[15]. Place names indicate that both the Saxons and Danes settled in the area, and the extensive river system was used by invading Angles and Danes to penetrate deep into the country.

The slightly higher, drier land inland formed islands within the wetland, enabling early settlement during the medieval period, shown by the remnants of turbaries (peat cutting), 'ridge and furrow' fields as well as the largest stretch of open strip field systems in the country at the Isle of Axholme, which is of international significance[16]. Towns developed along river trade routes and moated sites were established to the north of Doncaster, and around the Isle of Axholme.

The Humber continued to have great importance for trade and communication, with populations and wealth increasing through the medieval period. The historic landscape was altered from the 17th century by the extensive drainage and flood protection works reclaiming areas from the sea and protecting developing towns and industrial areas. In the 16th and 17th centuries, the area declined in prosperity as a result of competition for trade and improvements to inland transport systems. Hull, however, prospered and became the principal port and town in the area[17].

A key part of the cultural heritage interest in the study area is associated with the management of water and industrial activity, evidenced by old river courses such as the Don, historic ditches, berms, dykes, canals, bridges, disused windmills, water towers and canals, reflecting both the reclamation of the area for cultivation and the importance of the waterways as major transport routes[13]. Many of these assets are linked by historic footpaths, and these collectively with the assets themselves contribute towards the opportunity for interpretation of the historic landscape.

5.5.2 Statutory designations

There are 59 Scheduled Monuments within the study area, a designation that protects heritage features of national importance. 34 of the Scheduled Monuments are found at East Riding of Yorkshire, three within Kingston Upon Hull, one within North East Lincolnshire, eight within North Lincolnshire, four within Selby District and nine within Doncaster Metropolitan Borough.

There are 35 Grade I Listed Buildings within the study area which are widely distributed across eight of the local authorities: Doncaster, East Lindsey, East Riding, Hull, North East Lincolnshire, North Lincolnshire, Selby and West Lindsey. There are also many more Grade II and Grade II* Listed Buildings, though for this report these are not considered. However, it is worth noting that the Humber Bridge is Grade I listed and Hull Barrier is Grade II listed.

Conservation Areas, designated for their special architectural and historic interest are found in the study area. There are no World Heritage Sites or Protected Wreck Sites within the study area. The designated sites are shown in Figure 15 in Appendix 2.

5.5.3 Archaeology

Within the study area, there are significant palaeo-environmental and archaeological evidence that are preserved within the Estuary's wetland soils, for example bronze-age boats have been discovered in the intertidal areas. There are many known archaeological finds in the study area, including, pottery finds, flint finds and paleoenvironmental data (Cambridge Studios (Sheils Flynn), unpublished). Areas of Archaeological Potential are areas where archaeological finds are considered to be likely, possibly due to previous finds within the location. The majority of the study area at and near to the Humber Estuary is either an important Areas of Archaeological

[15] Natural England National Character Area 41 Humber Estuary: http://publications.naturalengland.org.uk/publication/2285747 (accessed 02.10.2017)
[16] Natural England National Character Area 39 Humberhead Levels: http://publications.naturalengland.org.uk/publication/1843305?category=587130 (accessed 05.11.2017)
[17] Natural England National Character Area 41 Humber Estuary: http://publications.naturalengland.org.uk/publication/2285747 (accessed 02.10.2017)

Potential, or an Area with High Archaeological Potential. A map of archaeological potential is reproduced from the Humber Landscape and Green Investment Study in Figure 16 of Appendix 2.

Future trend:

- Sea level rise linked with climate change might pose risks to heritage assets or buried archaeology not already at risk of flooding. Conversely it might aid in preservation of palaeo environmental and archaeological features that are at risk of being dried out.
- Challenges might arise in the future on selecting which heritage features to protect and/or manage in a continually changing landscape.

Strategic issues:

- The Estuary and its floodplain contain a complex array of historic buildings, settlements, landscapes and archaeological sites that are a fundamental component of the regional identity and focus for education, tourism and recreation, which the Humber 2100+ Strategy must consider; as much as reducing disturbance to these sites are important, the Strategy could seek opportunities to protect and enhance these assets.

There are no known strategic issues relating to buried archaeology, but at a local level, the Strategy options could present risks to 'unknown' or buried archaeology, or present opportunities to improve understanding of this resource, or aid in the preservation of palaeo-environmental and archaeological features from being dried out. The Strategy will need to consider and respond to short-term and long-term implications for heritage assets.

5.6 Climate change

The Climate Change Act 2008 set a UK government target for reducing greenhouse gas emissions and to make provisions for adapting to climate change, amongst other things. Climate change adaptation refers to *making changes to prepare for and negate the effects of climate change, thereby reducing the vulnerability of communities and ecosystems. Adaptation can occur as a response to an event or in anticipation of an event. By adapting to cope with the effects of climate change, communities, enterprises and institutions can build up their climate change resilience* (Action on Climate, 2015).

Under the 2008 Climate Change Act, the UK government is required to publish a UK-wide Climate Change Risk Assessment (CCRA) every five years, which asses the risks for the United Kingdom from current and predicted impacts of climate change. The CCRA consists of a series of 'evidence' collated from a number of different sources including local authorities, including East Riding of Yorkshire Council.

The Humber 2100+ Strategy will consider climate change impacts by estimating the flood water levels with predicted sea level rise scenarios to predict flood risk in the study area, and propose a programme of coordinated measures for improving climate change adaptation and resilience in the study area.

Future trend:

- Climate change predictions show that temperatures will continue to rise, winter rainfall will increase, more rain will fall in intense storms and sea level rise will continue. This is predicted to result in increased flooding and foreshore erosion, which without coordinated FRM activities, would lead to the existing defences being breached or overtopped and the large low-lying areas behind the defences being inundated more frequently.

Strategic issues:

- The Strategy will consider how to help communities to adapt to climate change effects (sea level rise, storm events, extreme weather).
- The embedded carbon of the Strategy proposals will be considered to help select a sustainable approach to flood risk management.

5.7 Waste and contaminated land

There are over 150 historic landfill sites across the study area. The landfill sites cover all types of waste, including inert waste, industrial waste, commercial waste, household waste, special waste and liquid and sludge. Active landfill sites and known or potential contaminated land within the study area are located across the whole study area. There might be water pollution related issues with landfills within the study area. These sites are shown on Figure 18 in Appendix 2, prepared using data supplied from Environment Agency data and from some local authorities within the study area.

Where the Strategy options are likely to interact with these landfill sites, location specific baseline will be reviewed at a later stage to inform the SA, alongside site-specific information, for example, the East Riding of Yorkshire Contaminated Land Inspection Strategy.

Strategic issues:

- Consideration must be given to the location of active and historic landfill sites when assessing the strategy options to identify potential impacts of flood risk and works on soil and water pollution.
- Potential opportunities in terms of land remediation may be identified in the Strategy where these coincide with Strategy proposals.
- Consider a strategic approach to minimising the waste and materials use of the Humber 2100+ Strategy proposals.

6. Sustainability Appraisal (SA) Framework

6.1 Introduction

The Appraisal Framework enables the likely effects of the proposed Humber 2100+ Strategy to be assessed and measured against in the SA. This is done through setting out the objectives of the SA assessment in a framework, together with the decision-making criteria and indicators which will be used in the assessment.

The proposed SA Framework that has been developed to assess the new Strategy is presented in Table 6.1. It is divided into social, economic and environmental themes. The SA Framework will be revised based on consultation comments received, availability of further baseline information, and any issues and opportunities that may not have been identified to date. An agreed version of the SA Framework is intended to be created at the end of this consultation. Any changes or suggestions to the SA Framework should therefore be put forward by stakeholders during this consultation.

6.2 Scoping of SA topics

This section will discuss the key social, economic and environmental issues that are currently proposed to be addressed within the SA and those that will be scoped out.

The SA will not address any impact likely to result during the implementation of any built solution, for example construction impacts or raising of coastal defences at a local level. However, the cumulative effects on receptors at an estuary level will be considered. An exception to reporting on construction impacts at a local level will be dependent on the severity of impact which cannot be mitigated and on the reversibility, or irreversibility of the predicted impact. Most construction issues are more appropriately considered during project-level Environmental Impact Assessment (EIA) undertaken for specific schemes.

Table 6.1 Summary of issues scoped in and out of the Humber 2100+ SA

SA topic	Issue – Scoped in	Issue – Scoped out
Population and human health	Population and properties within flood risk areas. Socially deprived communities whose quality of life may be affected by flood risk management. Access to the countryside via rights of way and cycle routes and recreation destinations that may be affected by flood risk management decisions or pedestrian access to coast that may be affected by flood risk management decisions. Green infrastructure that may be affected by flood risk management decisions.	**Noise and vibration:** The effect of flood risk management projects that arise out of the Strategy on human receptors due to noise should be considered at project EIA stage.
Place and communities		**Air quality:** There are four Air quality management areas within the Study Area. Much of their management will be dependent on local intervention which the Strategy is unlikely to influence. The impact of projects that arise out of the Strategy on receptors will reviewed at project level through an EIA.
Economic growth and economic development	Existing and proposed housing, industry, commercial and economic activities as well as tourist, recreational and amenity resources that may be affected by flood and coastal management decisions.	
Rural land-use and rural economy	Grade 1 and 2 agricultural land that may be affected by flood risk management decisions.	**Geology and soils:** The Strategy will not have a significant effect on local geology or soils but these may require consideration at project EIA stage.

SA topic	Issue – Scoped in	Issue – Scoped out
	Issues and opportunities linked to agricultural land-use, including soil erosion or loss of top soil.	
Material assets	Critical infrastructure (CAT 3-5) that may be affected by Strategy, including transport networks. Navigation routes that may be affected by Strategy. Current and safeguarded mineral extraction areas that may be affected by flood risk management activities. Current or historic landfill sites and contaminated land may be affected by flood and coastal management decisions, positively (remediation) or negatively (flooding and water pollution).	
Biodiversity	International (Ramsar, SPA and SAC), national (SSSI, NNR) and local conservation sites may be affected by flooding and defence intervention and/or by coastal squeeze. Priority habitats known to be found within the study area (based on available information).	**Individual species:** Individual protected, rate or notable species. These will be surveyed, where appropriate, as part of individual scheme development.
Water	WFD waterbodies that may be affected by the Strategy.	**Drainage:** Small-scale drainage systems, and the effect of the Strategy on these or vice-versa, unless discussed as part of the Strategy.
Geo-morphology	Geomorphology of the estuary and rivers that could be affected by flood risk management decisions.	
Landscape, townscape and seascape	Landscape character areas, local character and Heritage Coast that could be significantly affected by flood risk management decisions.	**Visual amenity:** Visual amenity and potential view impacts from small/ individual interventions (for example raising defence at specific locations) on individual or small settlement type receptors should assessed at the project EIA stage.
Heritage and archaeology	Known designated assets and their settings including scheduled monuments, listed buildings, Registered Parks and Gardens, conservation areas and the potential for 'unknown' or buried archaeological remains within study area that may be affected by flood risk management decisions. Known non-designated sites, where information is available from local authorities.	**Climate change cause:** The Strategy will not address the issues that cause climate change. It will also not discuss other indicators of greenhouse gas emissions associated with the Strategy, other than embodied carbon.

SA topic	Issue – Scoped in	Issue – Scoped out
Cumulative Effects and Evolution of Baseline	Inter-relationships between topics where relevant i.e. where strategic options give rise to the potential for secondary or indirect effects. Synergistic effects. Cumulative effects from other proposed developments at a high level. Evolution of baseline in absence of Strategy i.e., do-nothing will be assessed.	Cumulative effects of small-scale developments, due to the strategic nature of the study.

Based on the review of the key sustainability baseline for the study area on environmental, social and economic factors (see sections 4 and 5), and key messages from the relevant plans and policies (see section 3 and Appendix 1), sustainability topics were selected for the assessment.

The topics that have been selected reflect the topics listed in: Annex I of Directive 2001/42/EC of the European Parliament on '*The Assessment of The Effects of Certain Plans and Programmes*' (the SEA Directive); and *Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents*, ODPM, November 2005.

6.3 SA objectives and criteria

The next step was to identify and develop the sustainability (SA) objectives. The objectives have been focussed on those issues that are directly relevant to the Humber 2100+ study area.

A range of criteria and indicators associated with achieving the objectives have been identified to provide guidance for the future appraisal process. The criteria focus specifically on the items which are of direct relevance to the Strategy and study area. The criteria are essentially sub-objectives, to serve as guidance questions for the appraiser. The SA objectives are not mutually exclusive, as with the sustainability topics, for example cultural heritage, landscape and rural economy are all inter-linked. The inter-relationships are also listed in Table 6.2. The acknowledgement of such inter-relationships will continue in later stages of the SA process.

6.4 Potential monitoring indicators

The potential monitoring indicators outlined in the following SA Framework for each objective are primarily derived from relevant indicators identified at the European, national, regional and local level. These indicators could form the basis for a future Strategy monitoring plan, and can be used to measure progress against the identified SA objectives.

The SA Framework Table

Table 6.2 SA Framework Table

**text in italics relate to Environment Agency statutory duties*

Topic	Objective	Criteria	Inter-relationship with topics	Potential indicators/ monitoring information
SOCIAL FACTORS				
1. Population and human health	To manage risk of flooding to the existing and the growing population, including the socially vulnerable population.	Will the option affect current level of flood risk to people and property and settlements?	Place and communities	Standards of Protection Population within the floodplain Risk to Life
		Will the option address flood risk in the 20% Most deprived areas?		
		Will the option be effective in addressing flood risk for future⊕ housing developments in the area?		
2. Place and communities	To maintain or improve access links to civic amenities, greenspaces and to minimise impact on viability of settlements.	Does the option affect access or connectivity for the communities? For example, PROW, cycle paths, bridle paths, access to waterfronts, coastal path (and Heritage Coast), countryside, features that contribute to well-being or recreational and green infrastructure?	Population and Human health; Material assets	Length of footpaths access, quality and quantity of recreational resources Humber Estuary Integrated Landscape and Investment Study Local Green Infrastructure Strategies and Policies delivery
		Does the option affect access or connectivity for smaller rural settlements? For example, access to GPs, post offices, schools etc.	Population and Human health; Material assets	
		Will the option help safeguard of existing greenspaces, including open spaces, common, amenity space, child and young people play area and/ or ecological corridors?	Landscape character; Population and Human health; Biodiversity	

⊕ Refers to proposals in the relevant Planning Authority Local Plan

		Will the option support or enable the provision of new green-blue infrastructure?	Biodiversity; Landscape character	
		Will the option create conditions that could have an impact on community severance and/ or viability of communities/ settlements?	Material assets; Population and Human health	
ECONOMIC FACTORS				
3. Economic development	Manage the flood risk to support and where possible enhance the local and wider economy	Will the option have an impact on inward investment in the study area and on large scale indigenous business growth in the study area?	Population and Human health	Number of days agricultural land flooded
		Does the option affect existing employment land or their viability?	Material assets	
		Does the option affect proposed⊕ employment land or their viability?	Climate change; Material assets	
		Will the option affect countryside communities and rural economy?	Rural land-use	
		Will the option affect viability of existing or proposed tourist and visitor attractions or create new tourist development and education opportunities?	Places and communities	
		Will the option present opportunities to adapt agriculture related land-use? For example, flood risk resilient farming or agri-tourism?	Rural land-use; Places and communities; Climate change	
4. Rural land use		Does the option affect existing or proposed high value (grade 1 and 2) agricultural land?	Population and human health	Agricultural Land

⊕ Refers to proposals in the relevant Planning Authority Local Plan

	To minimise loss of agricultural and farming land and to promote soil remediation	Does the option provide the opportunity to manage or reduce flood risk to improve productivity of agricultural land?	Population and human health; Economic development	Classification Grade Number of days agricultural land flooded Changes to agricultural output Agricultural Land Classification Grade Number of days agricultural land flooded
5. Material assets	To support the operation and maintenance of existing and proposed material assets.	Will the option help manage flood risk to the strategic road network and transport infrastructure, such as railway stations and wharfs?	Economic development; Place and communities	Connection of transport infrastructure routes
		Will the option help manage flood risk to critical infrastructure?	Population and human health; Place and communities	Vulnerability to flooding (depth and duration) of roads
		Will the option affect current navigation routes?	Place and communities	Length of navigable river
		Will the option support the development of new critical infrastructure?	Economic development; Population and Human health; Rural land-use	Connection of transport infrastructure routes
		Will the option affect operations of current mineral sites?	Economic development	Changes to gravels and minerals extraction sites
		Will the option affect safeguarded mineral sites?	Economic development	
		Will the option affect land-fill sites, current or historic or contaminated land	Population and Human health; Biodiversity	Waste management sites

ENVIRONMENTAL FACTORS				
6. Biodiversity	Conserve and enhance habitats, biodiversity, ecological corridors and create enabling environments for biodiversity	*Will the option manage tidal flood risk in a way which facilitates enhancement (or prevents deterioration) of international and nationally important habitats?*	Geomorphology; Water	Percentage achievement of conservation objectives for Natura 2000 sites Favourable condition status of SSSIs Habitats supporting protected species populations OM4a- hectares of net water-dependent habitat created OM4h- Hectares of habitat created through FCRM EA KPI768 – creation of priority habitats Percentage achievement of conservation objectives for Natura 2000 sites Favourable condition status of SSSIs OM4e- Kilometres of water body opened up to fish and/or eel passage through FCRM
		Will the option manage tidal flood risk in a way which enhances regional or locally important habitats? Does the option contribute to prevent habitat fragmentation?	Geomorphology; Water	
		Will the option lead to net gain in biodiversity or lead to no net loss to biodiversity	Climate change	
		Will the option affect resilience of habitats to climate change?		
		Will the option affect migratory routes of eels and fishes and/or affect nursery and spawning sites.	Water	
7. Water	To manage risks from tidal flooding to water resources and to maintain or enhance the water environment.	Will the option increase or reduce the likelihood of waterbodies within the Study Area achieving Good Ecological Potential by 2027 (in line with the WFD)?	Geomorphology; Biodiversity	WFD status (RBMP monitoring) OM4c- Kilometres of protected river protected OM4d Kilometres of WFD water body enhanced through FCRM
		Will the option *manage risk to saline intrusion and/or siltation* or the ingress of contaminants into a source protection zone or, ground/*surface water abstraction point*?	Geomorphology; Biodiversity	

		Will the option lead to a change in the availability of water resources, including for irrigation purposes?	Rural land-use	OM4e- Kilometres of water body opened up to fish and/or eel passage through FCRM Surface water quality Groundwater quality Source Protection Zone Surface water abstraction points Groundwater abstraction points
8. Geomorphology	To facilitate natural estuarine geomorphological processes.	Will the option work with natural processes and contribute to or complement the natural function of catchments including sediments, tidal prism, flow, erosion, rivers, floodplains and coasts?	Water; Biodiversity	WFD status (RBMP monitoring)
		Will the option enhance habitats such as saltmarshes that help dissipate wave energy at the coast?	Water; Biodiversity	Erosion and channel movements monitoring OM4b- hectares of net inter-tidal habitat created
9. Landscape, townscape and seascape character	To manage, conserve and/or enhance the character and quality of townscapes, landscapes and seascapes, maintaining and strengthening local distinctiveness and sense of place.	Will the option significantly affect the special qualities of sites or places of landscape, townscape or seascape value of regional, national or international importance?	Rural land-use; Places and communities; Economic development; Cultural heritage	NCAs and Local Landscape Character Areas showing no significant change or change consistent with character area descriptions and management strategies. Conservation Area appraisals Townscape Character Assessments Seascape Character Assessments Heritage Coasts
		Will the option manage tidal flood risks to the landscape character of the area and/or contribute to maintain or enhance the landscape character?		
		Will the option conserve or enhance the townscape, landscape and seascape character of the area contributing to maintaining or enhancing the sense of place?		

				AONBs Local Authority Areas of High Landscape Value Conservation Areas Registered Parks and Gardens
10. Cultural heritage	To manage, maintain and enhance cultural heritage assets and the historic environment	Will the option allow heritage assets to adapt to changes in flood management whilst retaining their significance and current societal value? Where a negative impact is proposed can a positive outcome be gained by the recording of the asset and making the results available to the public or through public participation?	Rural land-use; Economic development	Scheduled monuments Listed buildings Conservation Areas Designated and undesignated heritage places and assets of regional, national or international importance. Areas of significant archaeological and palaeo-environmental potential Damage to viability of cultural heritage assets of regional, national and international importance Sites and areas of heritage tourism and historic character Historic land-use activities/ reversion to a former land-use (which we now realise to be environmentally beneficial and more sustainable with the progression, evolution, of the landscape through climate/environmental changes)

11. Climate change	To enable climate change adaptation and resilience and to enhance carbon management opportunities	Will the option, if required provide sufficient time for community adaptation to climate change?	Population and human health	Standard of Protection
		Will the option, if required provide sufficient time for businesses, recreation and tourism centres for adaptation?	Economic development	Number of properties at flood risk
		Will the option allow sufficient information (including timescales) to allow infrastructure, for example water treatment plants or wastewater treatment plants and businesses to be relocated or adapted to climate change?,?	Material assets; Population and human health; Economic development	Type of utilities at flood risk Number of utilities at flood risk
		Will the option create opportunities for the generation of/ use of renewable sources, during operations and maintenance?	Economic development	Source of energy
		Will the option create opportunity to develop carbon neutral (balance carbon sink and carbon source) approach to flood risk management?	Rural land-use; Economic development	Carbon calculator

6.5 Compatibility testing

6.5.1 Purpose

A test of compatibility between the proposed Strategy objectives and the SA objectives (from the SA framework) is typically conducted at an early stage of a plan making process to help identify whether the Strategy or a plan is aligned with the principles of sustainable development, and if not, discuss how they might be integrated.

As well as helping to establish compatibility between the SA objectives and the Strategy objectives, the testing of compatibility is an opportunity to set the scene for the future assessment stages and to act as a guide for the SA team and the Strategy development team to ensure that sustainable development thinking is integral to the Strategy preparation process.

Eight Strategy objectives are proposed which can be broadly classified under four categories - engagement with stakeholders, working with partners, delivery and rigorous data analysis to inform decision making. These objectives were tested against the 11 SA objectives defined in the Framework above (section 6.5.3). It is acknowledged that the Strategy objectives will work on conjunction with each other, but for purposes of compatibility they are tested against each SA objective in isolation.

The Draft Strategy objectives are presented below, and the compatibility with the SA objectives (listed by topic) is given in Table 6.3.

6.5.2 Humber 2100+ Objectives

The Environment Agency, Local Authorities and the Humber LEP will work in partnership to support sustainable development and a prosperous Humber. We will do this by redefining the strategic approach to managing tidal flood risk on the Humber for our communities and the Country, setting the way forward for the next 100 years taking into account predicted sea level rise and climate change.

The new strategy, which builds on existing work, will be adopted by the Local Authority partners and will obtain Defra approval.

With our partners:

- We will support long-term, resilient, growth and maximise funding, by aligning flood risk investment with other stakeholders' and developers' infrastructure and economic growth programmes. We will ensure the agreed strategic solution delivers the most sustainable, cost-effective and suitable approach to managing tidal risk.
- We will deliver multi-benefit schemes, seeking to protect and enhance our natural capital, achieving environmental outcomes and delivery of social and economic enhancements through flood risk management.
- We will provide greater certainty and clear strategic direction, supporting investment and helping the Humber realise its full potential. We will deliver an adaptable approach to better protect homes and livelihoods, businesses and potential development opportunities from flooding, helping to promote sustainable economic growth, and improving resilience, taking account of climate change and sea level rise.
- We will make decisions that respond to local needs as well as the long term global trend of sea level rise. We will engage with stakeholders, local people, businesses and key industry partners to seek support, ideas, and agreement on innovative solutions to managing tidal flood risk around the estuary as well as improve their understanding of flood risk and the action they can take to reduce their own risk.
- We will share and use the best available data and most appropriate information on the existing defences, the current flood risk and how this may increase with climate change, to inform open and fair decisions about how to manage risk.

- We will ensure the Strategy is continually relevant, committing to necessary and timely reviews of the strategy, as we develop new understanding, including following significant tidal flooding, to ensure it continues to deliver its agreed objectives for the benefit of lives, livelihoods and infrastructure.

6.5.3 Compatibility between the Strategy objectives and the SA objectives

Table 6.3 Strategy objectives and SA objectives-compatibility matrix

Strategy objectives	SA1 – Population and human health	SA2 – Communities and connectivity	SA3 – Economic development	SA4 – Rural land-use	SA5 – Material assets	SA6 – Biodiversity	SA7 – Water	SA8 – Geomorphology	SA9 – Landscape, townscape and seascape character	SA10 – Cultural heritage	SA11 – Climate factors
1. The Environment Agency, Local Authorities and the Humber LEP will work in partnership to support sustainable development and a prosperous Humber. We will do this by redefining the strategic approach to managing tidal flood risk on the Humber for our communities and the Country, setting the way forward for the next 100 years taking into account predicted sea level rise and climate change.	C	C	C	C	C	C	C	C	C	C	C
2. The new strategy, which builds on existing work, will be adopted by the Local Authorities partners and we aim to obtain Defra approval in 2019.	C	C	C	C	C	C	C	C	C	C	C
With our partners											
3. We will support long-term, resilient, growth and maximise funding, by aligning flood risk investment with other stakeholders' and developers' infrastructure and economic growth programmes. We will ensure the agreed strategic solution delivers the most sustainable, cost-effective and suitable approach to managing tidal risk.	C	C	C	C	C	-	-	-	-	-	C
4. We will deliver multi-benefit schemes, seeking to protect and enhance our natural capital, achieving environmental outcomes and delivery of social and economic enhancements through flood risk management	C	C	C	C	C	C	C	C	C	C	C
5. We will provide greater certainty and clear strategic direction, supporting investment and helping the Humber realise its full potential. We will deliver an adaptable approach to better protect homes and livelihoods, businesses and potential development opportunities from flooding, helping to	C	C	C	C	C	-	-	-	-	-	C

	promote sustainable economic growth, and improving resilience, taking account of climate change and sea level rise.											
6.	We will make decisions that respond to local needs as well as the long-term global trend of sea level rise. We will engage with stakeholders, local people, businesses and key industry partners to seek support, ideas, and agreement on innovative solutions to managing tidal flood risk around the estuary as well as improve their understanding of flood risk and the action they can take to reduce their own risk.	C	C	C	?	-	-	-	-	-	-	C
7.	We will share and use the best available data and most appropriate information on the existing defences, the current flood risk and how this may increase with climate change, to inform open and fair decisions about how to manage risk.	C	C	C	C	C	C	C	C	C	C	C
8.	We will ensure the Strategy is continually relevant, committing to necessary and timely reviews of the strategy, as we develop new understanding, including following significant tidal flooding, to ensure it continues to deliver its agreed objectives for the benefit of lives, livelihoods and infrastructure.	-	-	-	-	-	-	-	-	-	-	-
c=compatible; - = no relation; ?= uncertain; nc= not compatible												

The results of the compatibility test (shown in Table 6.3) do not indicate any incompatibility. Most of the Strategy objectives are compatible with most SA objectives, although no relationship could be established between the SA objectives and Strategy objective 8, as it relates to the Strategy production process.

Strategy objective 4 (delivering sustainability enhancements) is fully compatible with all SA objectives as it specifically supports the delivery of schemes that will benefit the environmental, social and economic aspects and measures that support sustainable development.

As local authorities will be involved in the Strategy production process and that adherence to their own Local Plan policies relating to social, economic and environmental factors are likely to be tested through their engagement at a high level, Strategy objectives 1 and 2 are found to be compatible with all SA objectives.

7. Next steps

7.1 Next steps

The SA Scoping Report has been updated following consideration of the responses to the SA Scoping Report consultation held between December 2017 and January 2018 and subsequent revision of the study area boundary, to form this post-consultation Final SA Report. The updates mainly related to revisions to the baseline information and the plans and policies review (Appendix 1) and minor changes to the SA Framework. This SA Framework will now be adopted for use in the appraisal of the Humber 2100+ Strategy options.

As described in Table 1.1, the next stage in the SA will be to assess the initial Strategy options. This will be documented in the Initial Options Appraisal Report.

8. Abbreviations and glossary

Abbreviation/ term	Description
Adverse effect (on site integrity)	An effect on the qualifying interests of a European site which is negative in terms of the achievement of the conservation objectives for that site.
Alternative solutions	This is a part of the tests in Article 6(4) of the Directive and regulations 85C and 49 of the Habitats Regulations. In any exceptional case, where regulation 85C or 49 is applied to a proposed plan, the plan-making body must first be satisfied that there are no alternative solutions. The UK Government expects these special provisions to be used only in the most exceptional circumstances, with plans being amended to avoid adverse effects on European sites, so rendering the application of the alternative solutions test unnecessary.
Appropriate assessment (AA)	AA is one part of the Habitats Regulations Appraisal process. An AA is only required where the plan-making body determines that the plan is likely to have a significant effect on a European site in Great Britain, or a European Offshore Marine Site, either alone or in combination with other plans or projects, and the plan is not directly connected with or necessary to the conservation management of the site.
Artificial Water Bodies (AWB)	Article 2 (8) of the WFD defines an artificial water body as a 'body of surface water created by human activity'. WFD permits Member States to identify and designate artificial water bodies (AWB) and heavily modified water bodies (HMWB) according to Article 4(3) WFD. The assignment of less stringent objectives to water bodies and an extension of the timing for achieving the objectives is possible under other particular circumstances. These derogations are laid out in Articles 4(4) and 4(5) of the WFD.
Bioeconomy	The production of renewable biological resources and their conversion into food, feed, energy, chemicals and other materials is referred to as the bio economy.
Biodiversity opportunity areas	Biodiversity Opportunity Areas' are areas where conservation action, such as habitat creation, restoration or expansion, is likely to have the greatest benefit for biodiversity. They are centred on existing areas of biodiversity interest, but have a key role as areas which offer strategic opportunities for biodiversity enhancement.
Birds Directive	Directive 2009/147/EC of the European Parliament and of the European Council of 30th November 2009 on the conservation of wild birds.
CHaMP	Coastal Habitat Management Plan.

Abbreviation/ term	Description
Community Forests	Community Forests have a national accord with the Forestry Commission. Each Community Forest is a partnership between local authorities and local, regional and national partners including Natural England. The Community Forest programme creates high-quality environments for millions of people by revitalising derelict land and providing opportunities for leisure, recreation and cultural activities, and by enhancing biodiversity, preparing for climate change, and by supporting education, healthy living and social and economic development.
Competent authority	An expression used in the Habitats Directive and Habitats Regulations, referring to the authority that is responsible for making a decision about a project application or adopting a plan. Any public body or public office is capable of being a competent authority as defined by regulation 6 of the Habitats Regulations.
Conservation objectives	These are referred to, but not defined, in the Habitats Directive and Regulations. They are set by Natural England for each qualifying interest of each European site. They form the basis of assessing the potential effects of plans and projects on European sites.
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
Ecological connection	In the context of this report this is intended to refer to areas shared by qualifying interest habitats and species. In the context of SPAs this also includes foraging of SPA bird species.
Environment stewardship scheme	Run by Natural England, this is an incentive based agri-environment scheme aimed at encouraging farmers to adopt practices that will result in - reduced soil erosion; improved water quality; improve conditions for farmland wildlife; maintain and enhance landscape character as well as protect the historic environment.
European site	European Sites in this context are Special Protection Areas (SPA), classified under the EC Birds Directive 1979, and Special Areas of Conservation (SAC) designated under the EC Habitats Directive 19926. Footnote 2 of the DCLG guidance of 2006 correctly states that Ramsar sites are not European sites within the meaning of the legislation. However, the Government expects public authorities to treat all Ramsar sites and potential SPAs (pSPA) as if they are fully designated European Sites, for the purpose of considering development proposals that may affect them. Ramsar sites should

Abbreviation/ term	Description
	be included in the assessment. The collective term for European sites and Ramsar sites in this report is 'international sites.'
Flood and Coastal Erosion Risk Management (FCERM)	Significant flooding in 1998, 2000, 2005, 2007, 2009 and 2013 highlighted the need for comprehensive, integrated and forward-thinking approaches to managing flood and coastal erosion risks in England and Wales. The government's strategy for flood and coastal erosion risk management for England (Making Space for Water, MSfW) identifies that sustainable development should be firmly rooted in all flood and coastal erosion risk management decisions and operations (Defra, 2004).
Good Ecological Potential (GEP)	Ecological Status is classified in all Water Bodies. For Heavily Modified Water Bodies' and Artificial Water Bodies', a separate classification process applies because these water bodies cannot reach good ecological status due to socio-economic uses. Whether a HMWB or AWB meets its Ecological Potential or not is assessed by: • Identifying the impacts affecting the water body; • Identifying the mitigation measures necessary to ensure the hydromorphological characteristics of a water body are consistent with Good or Maximum Ecological Potential; • Assessing whether those measures have been taken. Where all applicable mitigation measures have already been taken or screened out, the water body can be classified as Good Ecological Potential or better. This will then be combined with the outcomes from other assessments to give an overall classification.
Gross Value Added (GVA)	GVA is a measure of the increase in the value of the economy due to the production of goods and services. It is measured at current basic prices, which include the effect of inflation, excluding taxes (less subsidies) on products (for example, Value Added Tax). GVA plus taxes (less subsidies) on products is equivalent to gross domestic product (GDP). Regional estimates of gross value added are measured using the income approach, sometimes denoted by GVA(I). This involves adding up the income generated by UK resident individuals or corporations in the production of goods and services. It is calculated gross of deductions for consumption of fixed capital, which is the amount of fixed assets used up in the process of production in any period.
Groundwater Safeguard Zones (SGZ)	SGZ's are designated where raw drinking water supplies (in this case groundwater) are at risk of deterioration due to the use of substances like pesticides or nitrates. This reduces the need to build expensive new drinking water treatment plants and helps Environment Agency to meet the Water Framework Directive.

Abbreviation/ term	Description
Groundwater Source Protection Zone (SPZ)	SPZs are areas of groundwater where there is a particular sensitivity to pollution risks due to the closeness of a drinking water source and how the groundwater flows to the source. They are used to protect abstractions used for public water supply and other forms of distribution to the public such as mineral and bottled water plants, breweries, and food production plants. Smaller abstractions for private potable water supply will have a default SPZ area defined for them. Generally, the closer the activity is to a groundwater source, then the greater the risk to groundwater
Habitats Directive	EC Council Directive 92/43/EEC of 21st May 1992 on the conservation of natural habitats and of wild fauna and flora.
Habitats Regulations	Covers both the EC Birds (Council Directive 2009/147/EC) and Habitats Directives (Council Directive 92/43/EEC). The Birds Directive protects all wild birds, their nests, eggs and habitats within the European Community. It gives EU member states the power and responsibility to classify Special Protection Areas (SPAs) to protect birds which are rare or vulnerable in Europe as well as all migratory birds which are regular visitors. The Habitats Directive builds on the Birds Directive by protecting natural habitats and other species of wild plants and animals. It gives EU member states the power and responsibility to Special Areas of Conservation (SACs). Together with the Birds Directive, it underpins a European network of protected areas known as Natura 2000. This network includes SPAs classified under the Birds Directive (SACs) classified under the Habitats Directive.
Habitats Regulations Assessment (HRA)	HRA is the whole procedure of plan appraisal, including deciding whether a plan is subject to the Regulations; the 'screening' process for determining whether an AA is required; and the AA stage itself, including consultation with Natural England.
HESMP	Humber Estuary Shoreline Management Plan. The HESMP provided the framework for investment in defences to reduce the risk of flooding to people, property and the environment. This has since been superseded by the Flamborough Head to Gibraltar Point Shoreline Management Plan and HFRMS.
Heavily Modified Water Body (HMWB)	HMWB are bodies of water which, as a result of physical alterations by human activity (for example straightening of a river - channelisation), are substantially changed in character and cannot, therefore, meet "good ecological status" (GES). WFD permits Member States to identify and designate artificial water bodies (AWB) and heavily modified water bodies (HMWB) according to Article 4(3) WFD. The assignment of less stringent objectives to water bodies and an extension of the timing for achieving the objectives is possible under other particular

Abbreviation/ term	Description
	circumstances. These derogations are laid out in Articles 4(4) and 4(5) of the WFD.
Humber 2100+ , also referred to as 'the project' or 'Strategy'	The current review and new version of the Humber Flood Risk Management Strategy that was published in 2008. The project will be undertaken in full partnership with the Lead Local Flood Authorities and Local Planning Authorities around the estuary, as well as other Statutory Agencies, Risk Management Authorities and other key stakeholders. The aim is to produce a revised Strategy that sets out the strategic approach to managing tidal flood risk around the Humber Estuary for the next 100 years and that is agreed and formally adopted by all partners.
Hydrological connection	Any pathways through which water could travel between two areas.
Imperative reasons of overriding public interest (IROPI)	This is a part of the tests in Article 6(4) of the Directive and regulations 85C and 49 of the Habitats Regulations. Different criteria relate to priority habitats. The UK Government expects these special provisions to be used only in the most exceptional circumstances. Plans should be amended to avoid adverse effects on European sites, so rendering the application of the imperative reasons of overriding public interest test unnecessary.
Indices of Multiple Deprivation- 10% Most deprived 20% Most deprived	The Indices of Deprivation 2015 provide a set of relative measures of deprivation for small areas (Lower-layer Super Output Areas) across England, based on seven different domains of deprivation: • Income Deprivation • Employment Deprivation • Education, Skills and Training Deprivation • Health Deprivation and Disability • Crime • Barriers to Housing and Services • Living Environment Deprivation Combining information from the seven domains produces an overall relative measure of deprivation, the Index of Multiple Deprivation. In addition, there are seven domain-level indices, and two supplementary indices: the Income Deprivation Affecting Children Index and the Income Deprivation Affecting Older People Index. It is common to describe how relatively deprived a neighbourhood is by saying whether it falls among the most deprived 10 per cent or 20 per cent. To help with this, deprivation 'deciles' allow you to describe an area as, for example, being amongst the 20 per cent most deprived neighbourhoods in the country.

Abbreviation/ term	Description
In combination	The requirement in the Habitats Regulations is to undertake an AA of a plan if it would be likely to have a significant effect on a European site "*either alone or in combination with other plans or projects*". The AA should take into account in combination effects where relevant.
Likely significant effect (LSE)	A likely effect is one that cannot be ruled out on the basis of objective information. The test is a '*likelihood*' of effects rather than a '*certainty*' of effects. Where a project is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on the site. The assessment of that risk must be made in the light, amongst other things, of the characteristics and specific environmental conditions of the site concerned. The identification of LSE requires AA to be carried out (see definition of AA in this glossary). Natural England (2009) guidance describes that an AA will be required as "*if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects*" Refer to the Waddenzee judgement at the end of this glossary.
Managed realignment areas	Managed realignment typically involves landward realignment of and existing flood defence embankment, creating an area of inter-tidal habitat. These sites may provide compensatory habitat, under the Habitats Regulations, to replace that lost through flood risk management activities around the estuary.
National Character Areas	National Character Areas (NCAs) divide England into 159 distinct natural areas, each defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity (Natural England, 2014). Typically, these areas share the same landscape characteristics and the profiles information linked with the NCAs contribute to decision making about development around these areas.
National Planning Policy Framework (NPPF)	The recent revision to the planning system in the year 2012 resulted in the production of the NPPF which replaces the previous Planning Policy Guidance and Planning Policy Statements. The NPPF gives more responsibility to the Local Authorities in the decision making of planning matters on the premise that the presumption for sustainable development is always upheld.
Natura 2000	The Europe-wide network of Special Protection Areas and Special Areas of Conservation, in all member states, that is intended to provide protection for the bird species and assemblages in

Abbreviation/ term	Description
	accordance with the Birds Directive, and for the species and habitats listed in Annexes 1 and 2 of the Habitats Directive.
Nitrate Vulnerable Zone (NVZ)	Areas designated as being at risk from agricultural nitrate pollution. Defra reviews NVZs every four years to account for changes in nitrate concentrations.
ODPM	Office of Deputy Prime Minister, now Department for Communities and Local Government (DCLG).
Predominantly rural (Census 2011 Urban-Rural classification)	≥ 50% of the resident population lives in rural areas or rural-related hub towns.
Predominantly urban, including urban with city and town and urban with minor conurbation (Census 2011 Urban-Rural classification)	≥ 74% of the resident population lives in urban areas.
Qualifying interests	The habitats or species for which a site has been classified (SPA) or designated (SAC).
Ramsar site	A site listed as a wetland of international importance under the provisions of the 'Ramsar Convention'. A Ramsar site is not a European site as a matter of law, but all Ramsar sites in England are also European sites and/ or Sites of Special Scientific Interest and are protected under the relevant statutory regime.
River Basin Management Plan (RBMP)	River basin management plans (RBMPs) set out how organisations, stakeholders and communities will work together to improve the water environment. See link for further details.
Screening	'Screening' is a term used in guidance for convenience, to describe the initial stages of the HRA in the consideration of whether the policies and proposals of a plan are likely to have a significant effect on a European site, either alone or in combination with other plans or projects, and should thus be subject to appropriate assessment. It is not a term used in either the Directive or the Regulations.
Sea level rise	The rise in sea level caused by thermal expansion of the oceans and to a lesser extent from melting of the ice caps and glaciers. Relative sea level rise refers to the effective change in sea level relative to the land surface and also takes account of long-term land movement.
Shoreline Management Plan (SMP)	The SMP is a high-level policy document from which the organisations that manage the shoreline set their long-term plan.
Site condition	Site condition gives an indication of the conservation status of habitats and species at the site level.

Abbreviation/ term	Description
	It is linked to the concept of 'favourable conservation status' which is defined in detail in Article 1 of the Habitats Directive; in summary, the conservation status is 'favourable' where all that is necessary to sustain the habitats or species in the long-term is in place.
Site integrity	See adverse effect (site integrity) above.
Special Area of Conservation (SAC)	Area designated in respect of habitats and/or species under Articles 3 – 5 of the EC Habitats Directive. All SACs are European sites and part of the Natura 2000 network. Special Areas of Conservation are protected sites which are designated under the European Commission Habitats Directive to conserve 189 habitat types (78 of which are in the UK) and 788 species across Europe (JNCC, Special Areas of Conservation (SAC), 2017).
Special Protection Area (SPA)	Area classified in respect of bird species under Article 4 of the Birds Directive. All SPAs are European sites and part of the Natura 2000 network.
Storm (tidal) surge	The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). The storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place.
Strategic Environmental Assessment (SEA)	The SEA procedure can be summarised as follows: an environmental report is prepared in which the likely significant effects on the environment and the reasonable alternatives of the proposed plan or programme are identified. The public and the environmental authorities are informed and consulted on the draft plan or programme and the environmental report prepared. The European SEA Directive 2001/42/EC required that all member states of the European Union should have ratified the Directive into their own country's law by 21 July 2004 and in England it is transposed as The Environmental Assessment of Plans and Programmes Regulations 2004.
Sustainability Appraisal (SA)	A Sustainability Appraisal (SA), typically conducted for Local Development Documents, is required under the new planning system for certain plans/strategies, by law this must also incorporate the requirements of the European Strategic Environmental Assessment Directive (SEA). The main purpose of the Sustainability Appraisal process is to predict the positive and negative impacts of policies, whether social, environmental or economic, at an early stage, allowing any negative effects to be mitigated against. The appraisal is subject to consultation, and takes place alongside the preparation of the plan/strategy.

Abbreviation/ term	Description
Waterbody status	The ecological component uses biological quality elements, hydro morphology, physio-chemical and pollutants to assess the state of a water body. Some water bodies cannot achieve good ecological status because of modifications and structures within the water body and so are classed as heavily modified, and have to reach Good Ecological Potential (GEP) through implementation of a series of mitigation measures outlined in the applicable River Basin Management Plan (RBMP).
Water Framework Directive	In October 2000 the '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' (Water Framework Directive or WFD) was adopted and came into force in December 2000. The purpose of the Directive is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. The Directive is transposed into national law in England through the following regulation: The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

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10. Appendices

If you would like to find out more about Humber 2100+, email the Humber Team at:

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