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Saltfleet to Gibraltar Point Strategy

Strategic Environmental Assessment: Environmental Report

May 2019

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List of abbreviations

Term	Meaning/Definition
AEP	Annual Exceedance Probability
ALC	Agricultural Land Classification
AOD	Above Ordanance Datum
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
DAS	Discretionary Advice Service
EA	Environment Agency
EC	European Council
EIA	Environmental Impact Assessment
EIFCA	Eastern Inshore Fisheries and Conservation Authority
ELC	European Landscape Convention
ELDC	East Lindsey District Council
EU	European Union
ER	Environmental Report
FCERM	Flood and Coastal Erosion Risk Management
FCRM	Flood and Coastal Risk Management
FDGiA	Flood Defence Grant in Aid
FLO	Fisheries Liaison Officer
FRMP	Flood Risk Management Plan
GEP	Good Ecological Potential
GES	Good Ecological Status
GLLEP	Greater Lincolnshire Local Enterprise Partnership
HECAG	Humber Estuary Coastal Authorities Group
HEO	Historic Environment Officer
HER	Historic Environment Record
HLC	Historic Landscape Characterisation
HRA	Habitat Regulations Assessment
IFCA	Inshore Fisheries and Conservation Authority
LBM	Lincolnshire Beach Management
LCA	Landscape Character Area
LCC	Lincolnshire County Council
LGS	Local Geological Site
LRO	Lincolnshire Research Observatory
LSE	Likely Significant Effect
LWS	Local Wildlife Site
LWT	Lincolnshire Wildlife Trust
MAFF	Ministry of Agriculture, Food and Fisheries
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPS	Marine Policy Statement
NE	Natural England
NERC	Natural Environment Rural Communities
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
OM	Outcome Measure
PDZ	Policy Development Zone
RBD	River Basin District
RBMP	River Basin Management Plan
RCA	Regional Character Area

RCZA	Rapid Coastal Zone Assessment
RIGS	Regionally Important Geological Sites
SAC	Special Area of Conservation
SCD	Scoping Consultation Document
SEA	Strategic Environmental Assessment
SINC	Site of Importance for Nature Conservation
SMP	Shoreline Management Plan
SP	Strategic Policy
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TKES	Triton Knoll Electrical System
TKOWF	Triton Knoll Offshore Wind Farm
WFD	Water Framework Directive

1. Introduction

1.1 Background

The Environment Agency is preparing a sustainable flood risk management strategy, in consultation with East Lindsey District Council (ELDC) and Lincolnshire County Council (LCC), to guide future coastal flood risk management and investment over the next 100 years along the Lincolnshire coastline between Saltfleet and Gibraltar Point – i.e. within the strategy area shown on Figure 1.1.

The Lincolnshire coastline is changing and the Saltfleet to Gibraltar Point Strategy (hereafter referred to as the 'strategy') is an opportunity to better understand how these changes will impact the area and seek sustainable coastal flood risk management solutions.

Coastal/tidal flood risk in the strategy area is currently managed by a system comprising sand dunes, seawalls and a managed beach, much of which has been artificially nourished via the 'Lincshore' scheme over the last two decades. Recent storms and associated damage to defences along parts of the coastal frontage have highlighted the importance of the current defences in managing coastal flood risk. The Lincshore beach nourishment scheme (recently renamed as the Lincolnshire Beach Management project) will continue to be implemented to reduce tidal flood risk to the coastal frontage as an interim solution (in the period 2018 to 2020) prior to the implementation of the recommendations of the strategy, which are currently proposed from 2021 onwards.

1.2 Strategic Environmental Assessment

As part of the strategy development, a Strategic Environmental Assessment (SEA) has been undertaken to systematically appraise the potential environmental effects (both positive and negative) of the implementation of the strategy.

The requirement to undertake statutory SEA in the European Union (EU) came about when the EC Directive (2001/42/EC) *'on the assessment of the effects of certain plans and programmes on the environment'*, known as the 'SEA Directive', came into force in 2004. The overall aim of the SEA Directive is to: "*provide a high level of protection to the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development*."

The SEA Directive is implemented in England through the *Environmental Assessment of Plans and Programmes Regulations* (SI 1633 2004) – the SEA Regulations. These Regulations provide a systematic method to consider likely effects on the environment and ensure environmental considerations are addressed as early as possible and in balance with technical and economic factors. They also require the delivery of multiple objectives and stakeholder inclusion.

The SEA Directive and associated Regulations make SEA a mandatory requirement for certain plans and programmes which are likely to have significant effects on the environment. The SEA Regulations do not formally require an SEA of flood risk management strategies. However, in accordance with best practice it was decided that an SEA should be undertaken to accompany this strategy and that statutory requirements and best practice guidance[1] should be followed to ensure that environmental factors are fully considered as part of the strategy development.

Details of the proposed approach to the SEA of this strategy are provided in Section 4.

[1] A Practical Guide to the Strategic Assessment Directive (ODPM, 2005).

Figure 1.1: The strategy area, which extends from Saltfleet to Gibraltar Point

1.3 Purpose and content of this report

This SEA Environmental Report sets out the results of the strategic environmental assessment of the proposed strategy; identifying potential effects and recommending actions to mitigate and monitor these. The content of this report has been prepared in accordance with the requirements of the SEA Directive and transposing Regulations and is structured in the following sections:

- Section 1: Introduction (this section) – sets out the context and purpose of the SEA and the content of this report.
- Section 2: The strategy – describes the need for, the development,and the key elements of the proposed strategy which are the subject of this SEA.

- Section 3: Baseline conditions – summarises existing conditions, the likely future evolution of this baseline in the absence of the strategy, and the links to other external plans that could influence or be influenced by the strategy and SEA.
- Section 4: Approach to the SEA – describes the approach to the SEA process, including a description of previous stages and the methodologies used for this current stage.
- Section 5: Stakeholder engagement – describes the extensive stakeholder engagement undertaken and how this has influenced the development of the strategy and the SEA.
- Section 6: Assessment of the proposed strategy – documents the assessment undertaken of the proposed strategy, identifying significant effects and proposing actions to mitigate adverse and uncertain effects during the future implementation of the strategy. The assessment considers the effects of the strategy proposals within the strategy period, including an assessment of potential effects in-combination with other plans and proposals within the strategy area.
- Section 7: Alternatives considered – describes the alternative options considered during the development of the strategy, discusses their potential environmental effects and identifies why they were not taken forward as part of the proposed strategy.
- Section 8: Conclusions, recommendations and next steps – summarises the effects of the proposed strategy and recommended mitigation measures; recommends future monitoring arrangements and identifies the next steps for the SEA process.

A set of Appendices provide additional information to supplement the main content of this report. These are referenced throughout the document as appropriate.

1.4 Consultation and how to comment on this report

Comments are invited on the content of the draft strategy and this Environmental Report as part of the public consultation on the proposed strategy. All comments received will be recorded and acknowledged, and used to influence how the strategy is finalised and implemented in the future.

Consultation on the draft strategy and this accompanying Environmental Report runs from 3rd June to 25th August 2019. Copies of the draft strategy and Environmental Report are available on request by calling 07840 639326, by emailing lincscoastline@environment-agency.gov.uk or by writing to our engagement officer Fé Toussaint, Ceres House, Searby Road, Lincoln, LN2 4DT. Files are also available online on www.consult.environment-agency.gov.uk/engagement/sgp.

Comments should be returned by e mail to lincscoastline@environment-agency.gov.uk or to Josh Ystenes by post to the following address:

Saltfleet to Gibraltar Point Strategy
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Peterborough, PE2 5ZR

1.5 Related assessments

As part of the strategy development, a Habitats Regulations Assessment (HRA) must be undertaken in accordance with the *Conservation of Habitats and Species Regulations* 2017[2], as amended (the 'Habitats Regulations'), to assess the effects of the strategy on internationally designated nature conservation sites – namely, Special Areas of Conservation (SAC), Special Protection Areas (SPA) and sites designated under the Ramsar Convention (Ramsar sites). This process requires, firstly, the undertaking of a strategic-level screening assessment to identify whether the strategy could give rise to any likely significant effects (LSE) on these sites, and if so, subsequent detailed "Appropriate Assessment" to identify whether there could be adverse effects

[2] The Conservation of Habitats and Species Regulations 2017 (SI 2017/1012) transpose the requirements of the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and the European Council Directive (2009/147/EC) on the conservation of wild birds (the Birds Directive).

on the ecological integrity of these sites. A conclusion of no adverse effect on integrity is required before the strategy can go ahead as proposed, unless there are imperative reasons of public interest.

Appendix A of this report provides a strategic LSE Stage 1 screening assessment of the strategy proposals and subsequent more detailed Stage 2 Appropriate Assessment in accordance with the Habitats Regulations. The findings of this Stage 1 assessment were discussed with Natural England at a Discretionary Advice Service (DAS) meeting on 27th November 2017 (see Record of Discussion document in Appendix A). Both documents were subsequently submitted to Natural England for approval, discussed at a DAS meeting on 7th December 2018 and approved in December 2018. The findings of these assessments have informed the SEA and are described in Section 6.4 of this report.

In addition, a compliance assessment has been undertaken to assess the impacts of the proposed strategy on the ecology, water quality and hydromorphology of relevant water bodies/Protected Areas[3] in terms of their defined objectives under the European Union (EU) Water Framework Directive (WFD)[4]. These objectives are set out in the 2015 Anglian River Basin Management Plan (RBMP) (Environment Agency, 2015) and the assessment considers any potential opportunities for delivering mitigation measures set out in the RBMP. Appendix B of this report documents the assessment of the compliance of the strategy proposals with WFD objectives and requirements.

[3] Protected Areas are defined under the WFD as areas requiring special protection under existing national or European legislation, either to protect their surface water or groundwater, or to conserve habitats or species that directly depend on those waters.

[4] Directive 2000/60/EC, transposed in England and Wales by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI 2017/407).

2. The proposed strategy

2.1 The strategy area

The strategy area comprises the low-lying Lincolnshire coastal floodplain, which extends up to 15 km inland and over 37 km along the coast, as shown on Figure 1.1. The strategy area extends from Saltfleet in the north to Gibraltar Point in the south and sits between the Humber Estuary strategy area to the north and The Wash strategy area to the south. In effect, this strategy area is considered to be one coastal flood cell although the coastal characteristics are different to the north of Mablethorpe and south of Skegness.

For the purposes of the strategy development, the strategy area is further sub-divided into three zones (A, B and C) based on the level of historic intervention as shown on Figure 2.1. These are: Zone A - Northern area: Saltfleet to Theddlethorpe (Meers Bank) (8 km length); Zone B - Central area: Mablethorpe (Meers Bank) to Skegness (Lifeboat Avenue) (25 km length); and Zone C - Southern area: Skegness (Lifeboat Avenue) to Gibraltar Point (5 km length). These zones are illustrated in Plates 2.1 to 2.3. These three zones are closely related to the Shoreline Management Plan (SMP) policy units N, O and P (refer to Section 2.3).

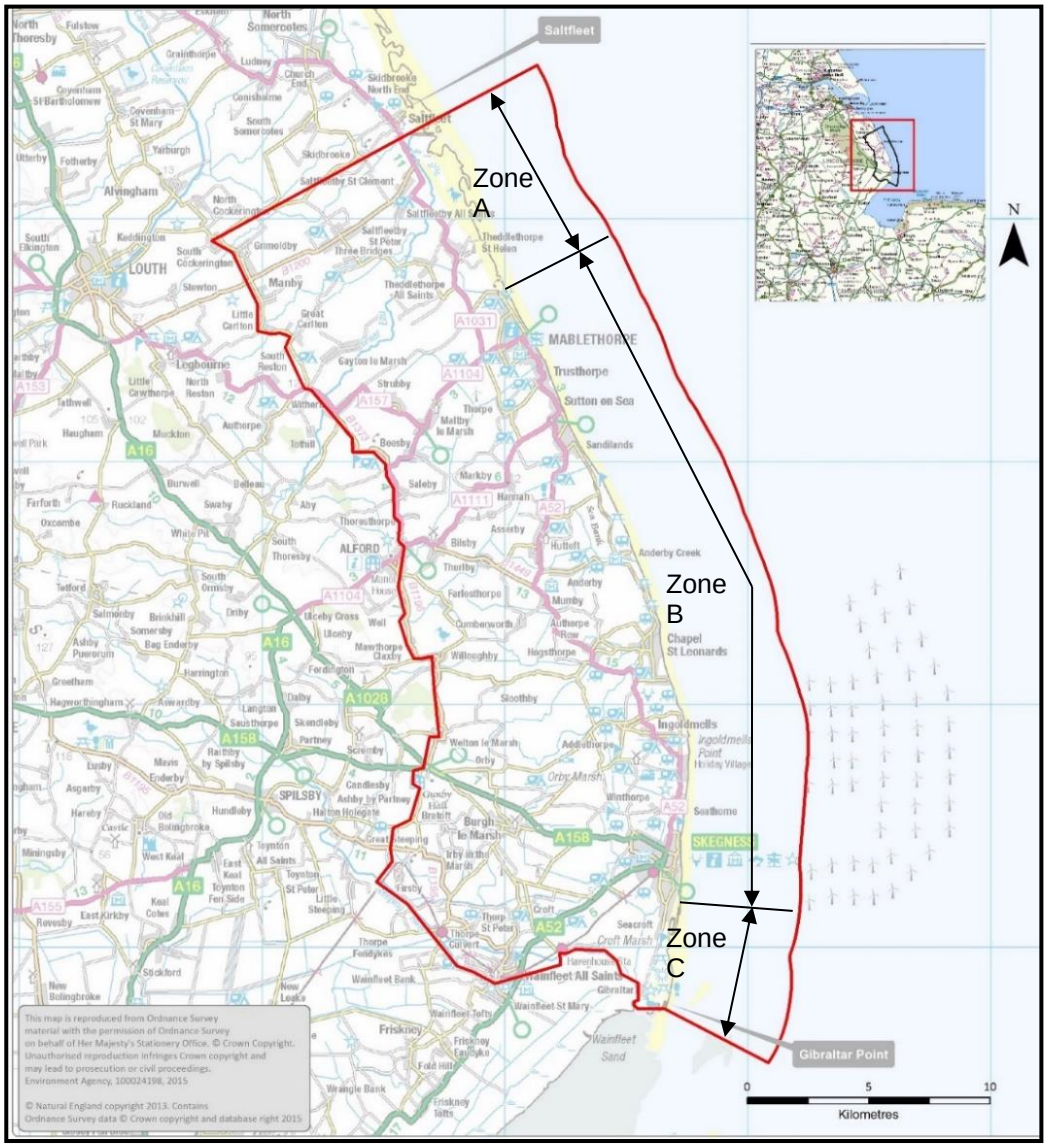


Figure 2.1: Zones identified within the strategy area

Plate 2.1: Saltfleetby – Theddlethorpe Dunes (Zone A)

Plate 2.2: Skegness – North Bracing beach, promenade and flood wall (Zone B)

Plate 2.3: Gibraltar Point (Zone C)

2.2 Background

Historically, the Lincolnshire coastline has been prone to catastrophic flooding, with records of damage dating back to the medieval period. A change in attitudes towards the defence of this shoreline followed development and expansion of the coastal towns and villages as tourist destinations in the late 1800s. This prompted the construction of seawalls and groynes along much of the shoreline. There was a major breach of these defences on the night of 31st January 1953 when a surge tide broke through in numerous places and 41 people were killed as a result of the flooding. Many defences were rebuilt in the aftermath which were subsequently rebuilt and improved over time.

In the late 1980s, studies suggested that the increasingly taller and wider seawalls and revetments were exacerbating the lowering of the beaches, compromising the toe of the defences. A different approach was therefore investigated to deliver a long term solution. A long term strategy defining the approach to deliver the 'hold the line' policy of the overarching first generation Shoreline Management Plan through beach nourishment was initially developed in 1991 – the 'Lincshore' strategy.

Nourishment of the beaches with material dredged from licensed sites in the North Sea was subsequently undertaken annually in a number of phases. The first phase of the strategy involved beach nourishment over a 2 km section to the north of Skegness, completed in August 1995. Construction of the second phase, over the 17 km frontage from Vickers Point to Mablethorpe, was undertaken between 1995 and 1998. The third phase, from 1999 to 2004, nourished the frontage to replace the losses due to natural processes. The strategy was reviewed in 2003/4, prior to the start of phase four (2004 – 2009). At that time, annual beach nourishment to protect the existing defences was again found to be the most acceptable option to reduce flood risk to a 0.5% annual chance of flooding (i.e. a 1 in 200 risk) for the 50 year appraisal period.

A performance review of this strategy was carried out in 2008, which increased the appraisal period to 100 years. This review recommended continuation of annual beach nourishment for the period 2010 to 2015, and was consistent with the 'hold the existing defence line' policy for the Lincolnshire coastline for this period recommended in the 2010 Humber Estuary Coastal Authorities Group (HECAG) SMP2 (see Table 2.1). This was implemented as the Lincshore 2010-2015 Scheme and comprised annual beach nourishment, recycling of sand (as required), removal of any remaining timber groynes, monitoring of beach levels and annual monitoring of environmental parameters.

Although the reviews of the strategy undertaken to date have concluded that the open beach (i.e. present management) solution is preferred in terms of economic, technical and environmental criteria, the long term sustainability, availability of sand, and affordability of annual recharge was highlighted as a potential concern when the 2010 – 2015 Lincshore scheme was approved. This was partly prompted by extending the economic appraisal period from 50 to 100 years which implied that alternative approaches, which involve larger upfront investment and lower long term costs, can be just as economically favourable (in present value[5] terms) as the present management approach (which in whole-life cash terms[6] is recognised to be much more expensive). Funding of the proposed strategy will be under Flood Defence Grant in Aid (FDGiA) rules which generally favour schemes that achieve the highest benefit/cost ratios. However, deferring costs into the future (e.g. delaying capital works expenditure by five or more years will considerably reduce the present value costs) or attracting "partnership funding" can make alternative approaches (such as the introduction of control structures) more favourable.

[5] Present value (PV) is the current worth of a future sum of money at a specific rate of return (the discount rate). The higher the discount rate, the lower the PV of the future cash flows. For example, the PV of £1,000 in ten years' time is £709 at a discount rate of 3.5%.

[6] Whole-life cost (WLC) refers to the total cost of ownership (construction and maintenance) over the life of an asset.

Whilst the current strategy is being developed, additional beach nourishment campaigns (and associated activities as described above) were undertaken up to 2017. Funding has also been approved to continue the present management approach each year from 2018 to 2020 (renamed as the Lincolnshire Beach Management project) prior to the strategy being implemented, currently planned for 2021. A marine licence covering beach nourishment and associated activities from 2016 to 2020 (Ref: L/2016/00118/1) has been obtained from the Marine Management Organisation (MMO) for this purpose.

2.3 Need for the strategy

The HECAG SMP2 2010[7] sets out the overarching policies for managing flood risk in the area between Flamborough Head and Gibraltar Point, including the outer Humber Estuary. The short, medium and long term policies for the policy zones within the strategy area are set out in Table 2.1.

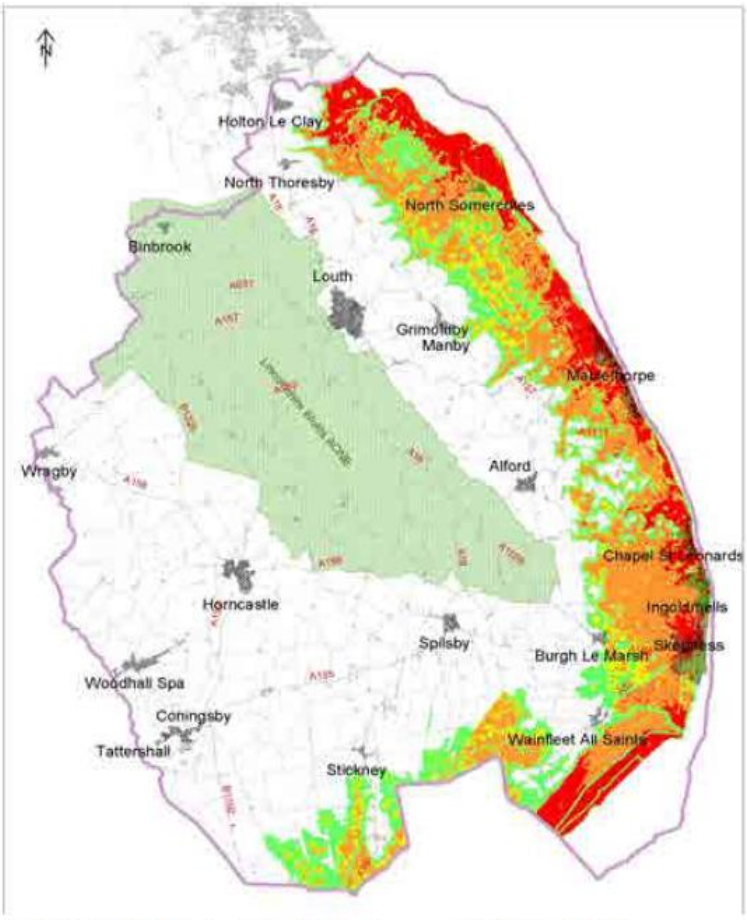
Table 2.1: SMP policies for the strategy area

	Policy Zone N: South of Humberston Fitties to Theddlethorpe **Strategy Zone A**	**Policy Zone O: Theddlethorpe St Helen to Skegness south** **Strategy Zone B**	**Policy Zone P: Skegness south to Gibraltar Point** **Strategy Zone C**
Short term (Present - 2025)	Hold the line	Hold the line	Hold the line
Medium term (2025 - 2055)	Hold the line	Hold the line	Hold the line
Long term (2055 - 2105)	Hold the line	Hold the Line / limited Managed Realignment considered where appropriate	Hold the line / limited Managed Realignment

Note: Policies include increasing activity level to sustain the existing level of flood risk into the future, compensating for future changes (such as sea level rise and increased storminess).

The existing coastal defences and annual beach nourishment scheme in the strategy area reduce flood risk to approximately 20,000 residential properties[8], 1,700 businesses (based on a flood with a 0.5% chance of occurring in any given year – see Figure 2.2) and approximately 24,500[9] caravans, as well as key infrastructure, tourism assets, recreational amenities and agricultural land.

[7] Note that the SMPs are reviewed periodically, with reviews imminent.
[8] Based on 2009 property counts, assuming that subsequent new developments are sufficient in terms of their own flood mitigation provision.
[9] ELDC (2018) East Lindsey Local Plan. Core Strategy. Adopted July 2018.



Flood Hazard Rating	Colour Code	Hazard Classification
0 to 0.75		Very Low Hazard - Caution
0.75 to 1.25		Danger for Some
1.25 to 2.0		Danger for Most
More than 2.0		Danger for All

Figure 2.2: Combined flood hazard map of East Lindsey areas at risk of flooding from breaching of sea defences in 2115 for a flood with a 0.5% annual chance of occurring (ELDC, 2018[10])

These receptors would regularly be at significant risk, with potential catastrophic consequences, similar to that experienced during the 1953 floods (see Plate 2.4) in the absence of the coastal defences and the annual beach nourishment scheme.

The defences were tested on 5th December 2013 when, during a period of high spring tides, the most serious storm surge since 1953 was experienced. This storm surge impacted many of the coastal and tidal flood defence assets in

Plate 2.4: Flooding at Mablethorpe in 1953 (Source: Environment Agency)

[10] ELDC (2018) East Lindsey Local Plan. Core Strategy. Adopted July 2018.

Lincolnshire and Norfolk causing damage at numerous locations, notably Boston in Lincolnshire. However, the vast majority of the defences held and protected communities at risk of flooding. In particular, although there was some erosion and reshaping of the nourished beaches between Mablethorpe and Skegness, the sea defences effectively protected people and properties in the coastal flood risk area. More recently, a storm surge event on 13th January 2017 also passed without incident.

The threat of global warming and rising sea levels will increase the risk of tidal flooding in the strategy area if flood risk management actions do not keep pace with future changes. The impacts of sea level rise will be to increase the overtopping and likelihood of failure of the existing defences, resulting in more frequent inundation of land in the hinterland of the defences, impacting on large parts of the human, natural and built environment.

Continued management and beach nourishment of the coastal frontage is therefore necessary to maintain a low risk (i.e. 0.5% annual chance) of flooding to existing land uses and many of the social and environmental assets, as set out in the SMP2 (HECAG, 2010). Beach nourishment has been undertaken to address the lowering of beach levels and prevent undermining of the existing seawall structure, which could lead to a breach and flooding of the low-lying land in the hinterland of the defences.

Nourishment of the beaches (using material dredged from offshore licenced areas) has been undertaken in a number of phases since 1994/95, and to date (up to the 2018 campaign, refer to Figure 2.3), nourishment of the 'Lincshore' frontage has cost around £160 million. It should be noted that since 2008, nourishment has mainly centered on six areas of frontage within Zone B designated as 'erosion hotspots'. In this way the present management regime currently nourishes the sections of beach that are most susceptible to erosion. The hotspot areas are as follows:

- Area 1 - Mablethorpe and Trusthorpe (including Sutton on Sea)
- Area 2 - Boygrift
- Area 3 - Huttoft and Moggs Eye
- Area 4 - Wolla Bank and Chapel Six Marshes
- Area 5 - Trunch Lane
- Area 6 - Ingoldmells

Funding has also been secured to continue the beach nourishment of these areas, under an interim beach management contract, until 2020. Works arising from the new strategy are currently planned from 2021 onwards.

It should be noted that since the adoption of the previous Mablethorpe to Skegness strategy in 2003/04, there have been significant changes to the funding of flood and coastal erosion risk management activities. Therefore, there is a need to fully review the approaches available for the future management of the wider frontage between Saltfleet and Gibraltar Point, and to determine how any future vision could be implemented (within the current FDGiA funding rules) to meet the needs of stakeholders.

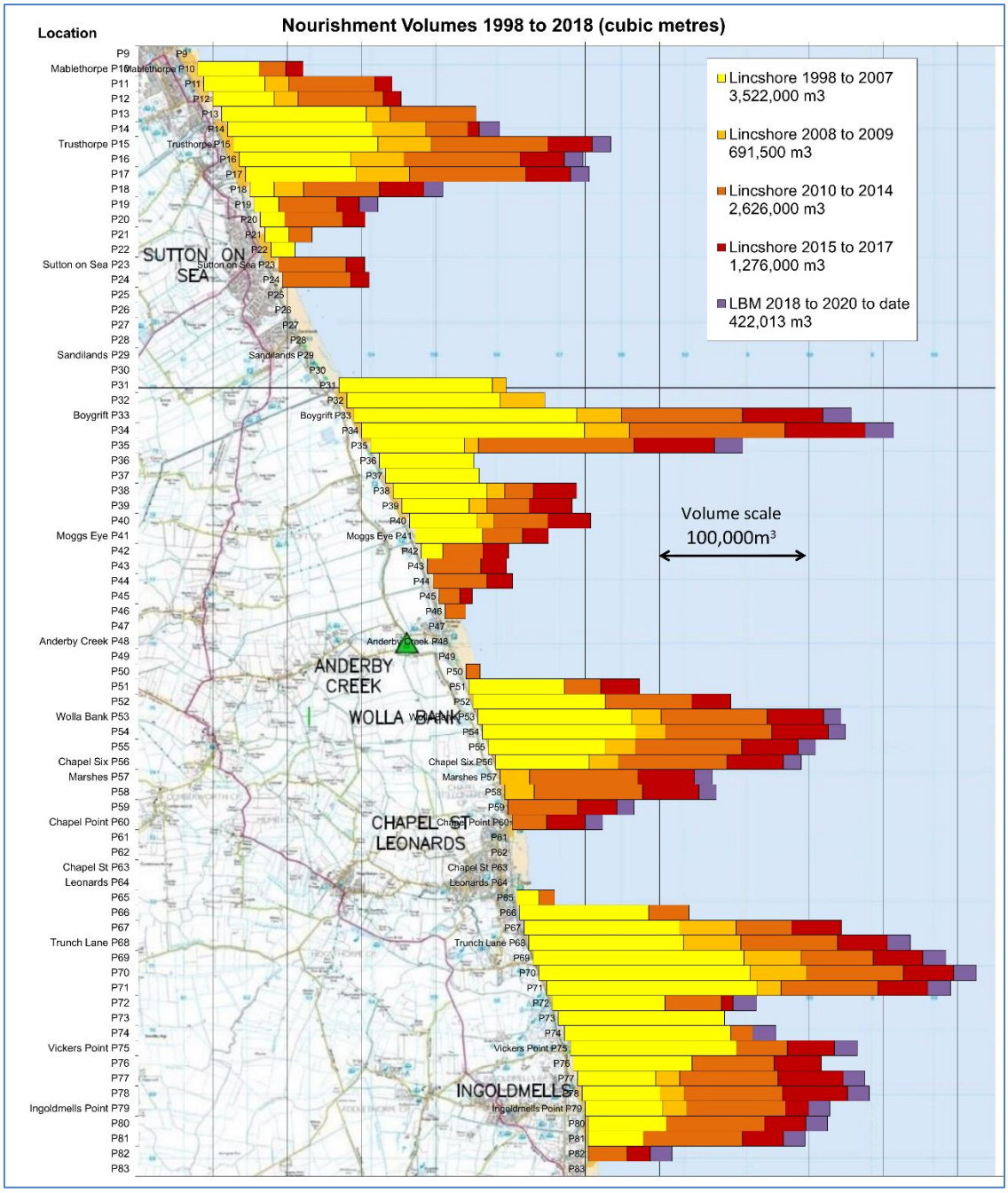


Figure 2.3: Beach nourishment locations and volumes over the last two decades

2.4 Strategy objectives

Through this strategy, we aim to create a better place for people and the environment, by working in partnership to manage the risk of flooding from the sea. The objectives of this strategy are to:

- Provide sustainable flood risk management over the 100 year term of the strategy;
- Mitigate against the risks of and adapt to the challenges of climate change and reduce our carbon footprint;
- Continue to investigate opportunities to secure the funding required to deliver the strategy;
- Protect the social, recreational, cultural, agricultural and commercial value of the coastal floodplain;

- Adapt to future opportunities, challenges and other key issues including tourism as well as environmental, social and economic factors; and
- Support sustainable and resilient development in the coastal floodplain for economic growth.

2.5 Development of the strategy

2.5.1 Approach, timescales and key drivers

The development of the strategy was a staged and iterative process as shown in Figure 2.4. From the starting point of the relevant SMP policies (refer to Table 2.1), multi-criteria technical appraisals and consultation with key stakeholders were undertaken to develop a long list of options; this was refined to a short list and the preferred strategic approach/options were subsequently identified. Consideration of potential environmental issues and opportunities was undertaken throughout this iterative process to inform the strategy development. Further details of this process are described in the following sections.

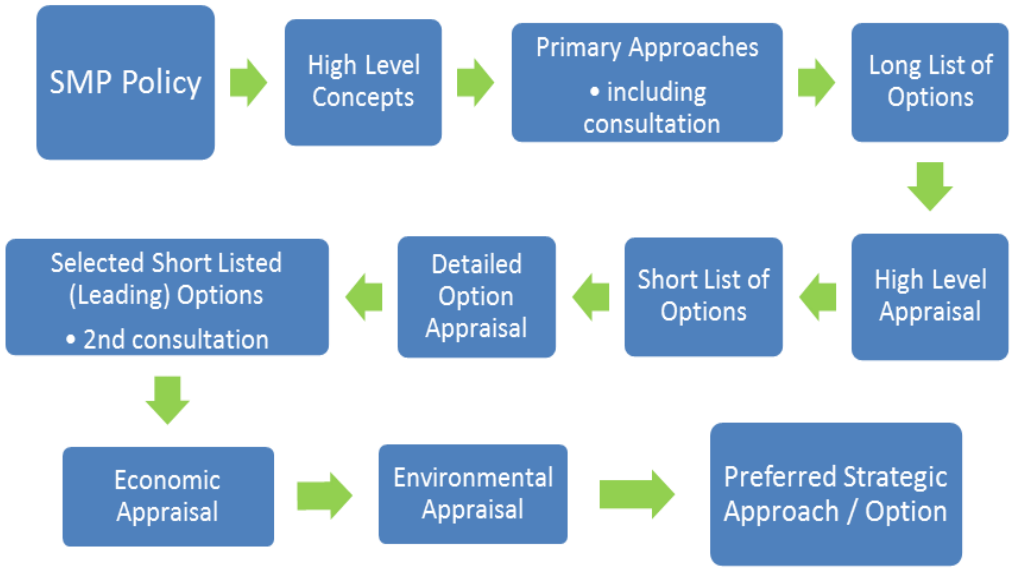


Figure 2.4: Stages undertaken to develop the strategy

In developing the strategy, the following timescales for implementation have been considered (strategy implementation will follow the current interim beach management scheme):

- Short term – the next 5 years (up to 2025), over which time a period of continued stability is expected to be needed, recognising that any changes will take time to plan for and begin to implement;
- Medium term – 6 to 35 years' time (2026-2055), further implementation or consolidation of approach; and
- Long term – decades into the future, with actual timescales triggered by events (e.g. sea level increase having reached certain levels) or circumstances (e.g. insufficient funding or resources available).

A significant consideration during the development of the strategy is the financial and economic constraints that would apply to the delivery of the potential management approaches and resulting options. Implementation of the preferred option would be spread in stages over the short, medium or long term (informed by monitoring and the exceedance of defined trigger points). Factors that would affect the affordability and therefore acceptability of the preferred strategy will influence the

programme of works. For example, an option to install control structures under a fast track (five to ten year) programme may be more economically viable over the lifetime of the strategy, although a longer term programme of works (spread over 20 years) will be more affordable.

2.5.2 Concepts and management approaches considered

Firstly, the concept of providing different levels of flood risk management was considered (i.e. from the present 0.5% Annual Exceedence Probability (AEP)/standard of flood protection) with reference to predicted sea level rise due to climate change. These high level concepts were:

- Do nothing – no active intervention and a resulting rapid decrease in the standard of protection provided over time as climate change impacts (sea level rise) occur;
- Do minimum - doing the minimum works necessary to maintain the defence. Doing minimum would involve ceasing regular beach nourishment and maintaining and reactively repairing (but not reconstructing) existing seawalls;
- Maintain – doing the works necessary (on a proactive basis) to maintain the defence line and the present standard of protection. However, this would exclude climate change impacts and this standard would, in effect, deteriorate over time;
- Sustain – doing the works necessary (on a proactive basis) to maintain the defence line, including for climate change, to sustain the present standard of protection over time and in line with predicted sea level rise; and
- Improve – increase the present standard of protection to provide a higher standard of protection than at present.

Whilst desirable from a social point of view, the 'improve' concept is, and continues to be economically unjustifiable under the present FDGiA guidance: the additional costs required simply outweigh the extra benefits generated. Therefore, in line with the SMP, this concept was discounted early in the appraisal process.

At this stage, the approach to and level of potential intervention within each of the Zones A, B and C were considered based on the SMP policies in the short, medium and long term. This concluded that in the short to medium term, no management actions would be required in Zones A or C due to these being more naturally accreting frontages. This would be subject to any significant changes that might occur during these epochs, in particular changes to the sediment supply from either the Humber or the Yorkshire (Holderness) coast. In the long term, and subject to any future changes or triggers, actions may be required in response to a defined sea level rise or significant beach losses actually occurring[11]. Therefore, the subsequent management approaches and options considered principally focused on Zone B – the coastal frontage between Mablethorpe and Skegness.

New approaches that reflect changing circumstances (i.e. climate change, increasing demands on funding, continued availability of beach nourishment material, etc.) and the improved knowledge of the frontage were identified. The alternative scenarios of 'doing nothing' or 'doing the minimum necessary' were also considered to provide an appropriate baseline. Thus, the management approaches considered were:

[11] The climate change assumptions, currently based on the UKCP09 upper end estimate, indicates increased storminess and sea level rise of up to 0.1 m in the short term (up to 10 years), up to 0.35 m in the medium term (up to 40 years) and up to 1.1 m in the long term (100 years): e.g. moderate increases to beach levels will be required to accommodate a 0.35 m estimated sea level rise in 40 years time. In Zone B, the optimum beach sand crest level may have to increase from today's level of 4.50 mAOD to a higher level of 4.80 mAOD. Actual nourishment volumes will be continuously monitored against predictions and subsequent nourishments will need to be adapted to target the most vulnerable areas, wherever they may be on the frontage. These climate change estimates will inevitably be updated in the future, and whilst the latest guidance will be used at the appropriate time, the current estimates are considered valid at this stage.

- Approach 1: assumes no active intervention in the future, allowing existing defence assets to fail and risks to increase. This is considered to be the base case against which other approaches can be assessed.
- Approach 2: the minimum amount of action or intervention needed to maintain the standard of service of the existing flood defence assets; this could include patch and repair works and would be reactive. This approach may have a limited life, e.g. due to climate change, but is also an alternative base case against which other 'do something' approaches can be assessed.
- Approach 3: Holding the Line (as a single continuous system) with a beach, including nourishment and recycling, seawall maintenance and the potential use of some control structures. Potential approaches include:
    - Carry on as at present (i.e. annual beach nourishment) or vary the existing practice, for example, change the frequency of nourishment, material grading, alternative placement of material, more intensive recycling of material.
    - Introduce control structures (e.g. rock or timber groynes or offshore breakwaters) along the beaches to significantly reduce the volume of nourishment material required over time by reducing alongshore transport and providing increased stability.
- Approach 4: Holding the Line (as a single continuous system) without beach nourishment and recycling. This approach would require a significant increase in the size and extent of the existing coastal defence structures (sea walls) as beach levels fall away.
- Approach 5: Dividing the coast into discrete compartments[12], stabilised with major control structures where needed, creating independent units within which tailored flood risk management approaches can be implemented (i.e. resulting in a combination of options in compartments along the coastline). This could create, for example, stable bays with no or little sediment exchange between them, located along the existing defended line or, in some places, further set back to create larger bays and dunes.

A series of stakeholder workshops were held in November 2016 (refer to Section 5 for further details) to seek initial views on the concepts and range of approaches under consideration. The feedback from these workshops indicated strong support for sustaining the present standard of flood protection and support for further consideration of Approaches 3 and 5. However, there was a lack of support for Approaches 1, 2 and 4.

The next stage was to develop these management approaches further to identify a suite of defined options that could be considered and assessed.

2.5.3 Identification and appraisal of options

From the initial approaches, a long list of 27 potential options was identified (see Section 7 or Appendix C for details), including the 'do nothing' base case. These were then subject to a high level multi-criteria technical appraisal that considered the costs and benefits of these options using a suite of environmental, economic and social factors (see Figure 2.5 and Appendix C for details). All 27 options were scored on a relative basis between 0 (worst performing) and 100 (best performing) based on whether their performance was closest to the best or worst performing option for each criterion. The scores for all criteria were added and the criteria weighted to reduce the long list to a short list of 13 best-performing ranked options (plus the do-nothing base case). These are presented in Table 2.2.

[12] Compartments are defined as self-contained sections of the coastline that enable differing flood risk management approaches.

The appraisal favoured options that would sustain the present standard of protection in line with predicted sea level rise and provide increased security in the long term; any options that would not provide a beach did not score highly and were discounted.

This assessment supported the stakeholder feedback received from the November 2016 workshops and discounted options relating to Approaches 1, 2 and 4 (except where necessary to include as a comparative base case i.e. do nothing and do minimum), but included options under Approaches 3 and 5.

This short list of 14 options was then subject to further detailed analysis using the following weighted criteria (see Appendix C):

(a) SEA objectives and assessment criteria (40%);

(b) technical and social criteria (40%); and

(c) other (broader) criteria (20%).

Options were scored in terms of whether they fully, partially or did/did not meet these criteria (from a range of +2 to -2). All options were assessed against a baseline of present day conditions, accounting (as far as possible) for changes over time in the future. This appraisal identified a reduced short list of six 'leading' options as listed in Table 2.2.

The six 'leading' options were then presented for further consideration at a series of stakeholder workshops held in July and September 2017 and were also the subject of further public consultation in February/March 2018. The public consultation was supported by a series of six 'drop in' sessions at locations along the coast as well as publication of information on the project website (https://consult.environment-agency.gov.uk/flood-and-coastal-risk-management/sgp/). Feedback from these workshops and the public consultation was then used to identify the preferred options and the proposals for the short, medium and long term as set out in the draft strategy: these options and proposals are the subject of the assessment in this SEA Environmental Report and have further been subjected to a detailed economic financial and technical evaluation.

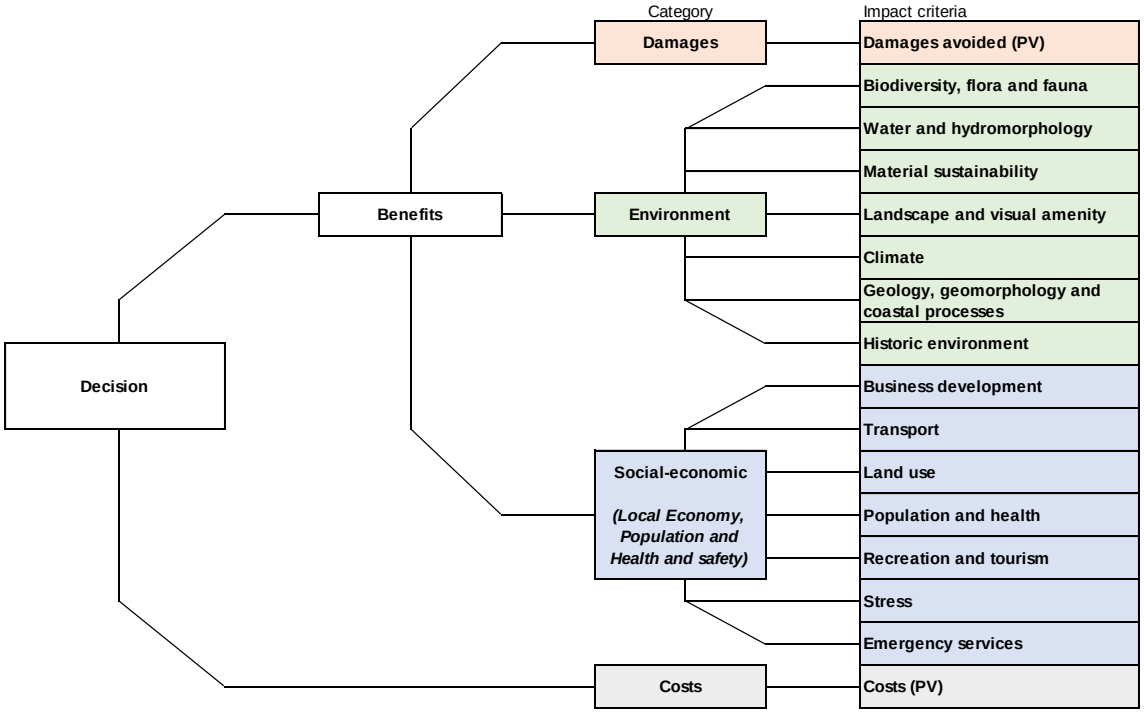


Figure 2.5: Criteria used for the high level appraisal of the long list of options

Table 2.2: Short-listed options, the six leading options subject to stakeholder/public consultation, and the options selected as part of the strategy proposals

Approach	**Option description** [option reference from Chapter 7/Appendix C]	**Leading options**	**Strategy proposals**
1: Do nothing	Do nothing (Base case). [1]		
2: Do minimum	Sustain - Doing the minimum works necessary to maintain the defence line including for climate change. [2.3]		
3: Open beach, with or without structures	Sustain - Annual nourishment (with present management), increasing volumes to maintain same standard of protection. [3.2]	✓	✓
	Sustain - Nourishment every 2 to 3 years increasing volumes to maintain same standard of protection. [3.4]		
	Sustain - Beach without control structures with different beach material grading. [3.7]	✓	
	Sustain - Beach with large rock armour fishtail breakwater control structures maintaining same standard of protection. [3.10]		
	Sustain - Beach with rock armour groynes structures maintaining same standard of protection. [3.11]	✓	
	Sustain - Beach with timber groynes structures maintaining same standard of protection. [3.12]		
	Sustain - Beach with rock armour structure combinations maintaining same standard of protection. [3.13]	✓	✓
	Sustain - Beach with rock armour structures at lower or higher standards of protection by changing nourishment volumes. [3.14]	✓	
	Sustain - Beach with rock armour structures at lower or higher standards of protection by changing nourishment frequency. [3.15]	✓	
5: Segment the coast	Sustain - Segment the coast with rock headlands and wider beaches. [5.1]		
	Sustain - Hardpoints plus single realignment and beaches in some locations. [5.2]		
	Sustain - Hardpoints plus multiple realignments and beaches in some locations. [5.3]		

2.6 Description of the proposed strategy

2.6.1 Overview of strategy proposals

The principal recommendation of the proposed strategy is to continue the present management approach of beach nourishment in the short term, to protect the landward coastal defences, and to introduce rock control structures in the medium term to reduce the losses of material and hence the volume and frequency of nourishment required over time. This approach will sustain the same

level of protection (i.e. an 0.5% AEP flood event) as currently afforded and keep pace with climate change. It will also retain a beach as part of the primary defence system.

This proposed strategy has been developed based on the results of the high level and detailed technical, economic and environmental appraisals described above, together with feedback from stakeholder workshops and public consultation described in Section 5.

This strategy will provide a configuration of control structures that significantly reduces reliance on the frequency and quantity of beach nourishment required in the medium to long term, whilst not having adverse effects on areas outside of the nourishment zones that depend upon the continued drift of sand. The nature and details of these will be established through a design process including modelling and monitoring, with the proposed approach being to phase the introduction of structures over several years, using each phase as an opportunity to refine subsequent phases of construction and reducing nourishment based upon performance.

The proposed strategy incorporates flexibility and adaptability to ensure that actions now will not compromise any development plans seeking a future change of direction, e.g. to incorporate growth and regeneration planning needs. The nature of the works to be undertaken are adaptable, which means that any investments in flood risk management made now that are in line with the proposed strategy would not become redundant.

This proposed change in approach from the present management (annual beach nourishment) is preferred as it offers a more certain and sustainable long-term outcome in terms of costs, carbon emissions, reliance on resources, and security to the area. Significantly, this approach will also allow discussions with partners to continue, to ensure that the position on future partnership funding and the opportunities for delivering on local plans for growth, joint working and wider benefits through local contributions are understood and held open for potential future agreements.

Although the proposed strategy sets out a clear direction and proposed change in approach in the medium to long term, there remains inherent uncertainty regarding the type and timing of actions that will be taken to implement the strategy depending on the availability of funding, future climate change and other triggers. To address this, the SEA of the strategy proposals considers two reasonable scenarios in the medium and long term to ensure that both solutions are assessed, i.e. (1) continuing with the present management approach; or (2) the preferred approach of introducing rock control structures to reduce the losses of material and hence the volume and frequency of nourishment required.

The key coastal flood risk management proposals in each zone in the short (0 to 5 years: 2021 to 2025), medium (6 to 30 years: 2026 to 2055 - divided into two stages in the draft strategy – see Section 2.6.2) and long term (31 to 100 years: 2056 to 2120) that form the basis of the proposed strategy, and are assessed within this SEA, are summarised in Table 2.3. Further details of the proposed approach are summarised in the following sub-sections. Detailed information regarding the design assumptions made for the SEA are provided in Appendix D.

Table 2.3: Summary of coastal flood risk management proposals in each zone in the short, medium and long term

Zone	Short term (to 2025): Stage 1	Medium term (2026 to 2055): Stages 2 and 3	Long term (2056 to 2120)
A	No active intervention (except for continuation of annual beach level monitoring).	No active intervention with monitoring of the beach, coastal marsh and dune systems. However, some minor interventions, e.g embankment raising, may be required if climate change	Interventions will be required to ensure continuation of sustainable flood defence in response to climate change. Interventions might include extending Zone B proposals northwards from Mablethorpe. These will require special consideration so as to not

Zone	Short term (to 2025): Stage 1	Medium term (2026 to 2055): Stages 2 and 3	Long term (2056 to 2120)
		triggers occur earlier than anticipated.	adversely affect known designated environmental assets.
B	Maintaining the open beach (with present management) through annual beach nourishment.	(1) maintaining the open beach through annual beach nourishment (present management); or (2) introducing rock control structures with reduced beach nourishment. Both scenarios will also require the raising of landward defences in the long term to sustain the standard of protection in line with sea level rise.	
C	No active intervention (except for continuation of annual beach level monitoring).	No active intervention with monitoring of the beach, coastal marsh and dune systems. However some minor interventions, e.g embankment raising, may be required if climate change triggers occur earlier than anticipated.	Interventions will be required to ensure continuation of sustainable flood defence in response to climate change. Interventions might include extending Zone B proposals southwards from Skegness. These will require special consideration so as to not adversely affect known designated environmental assets.

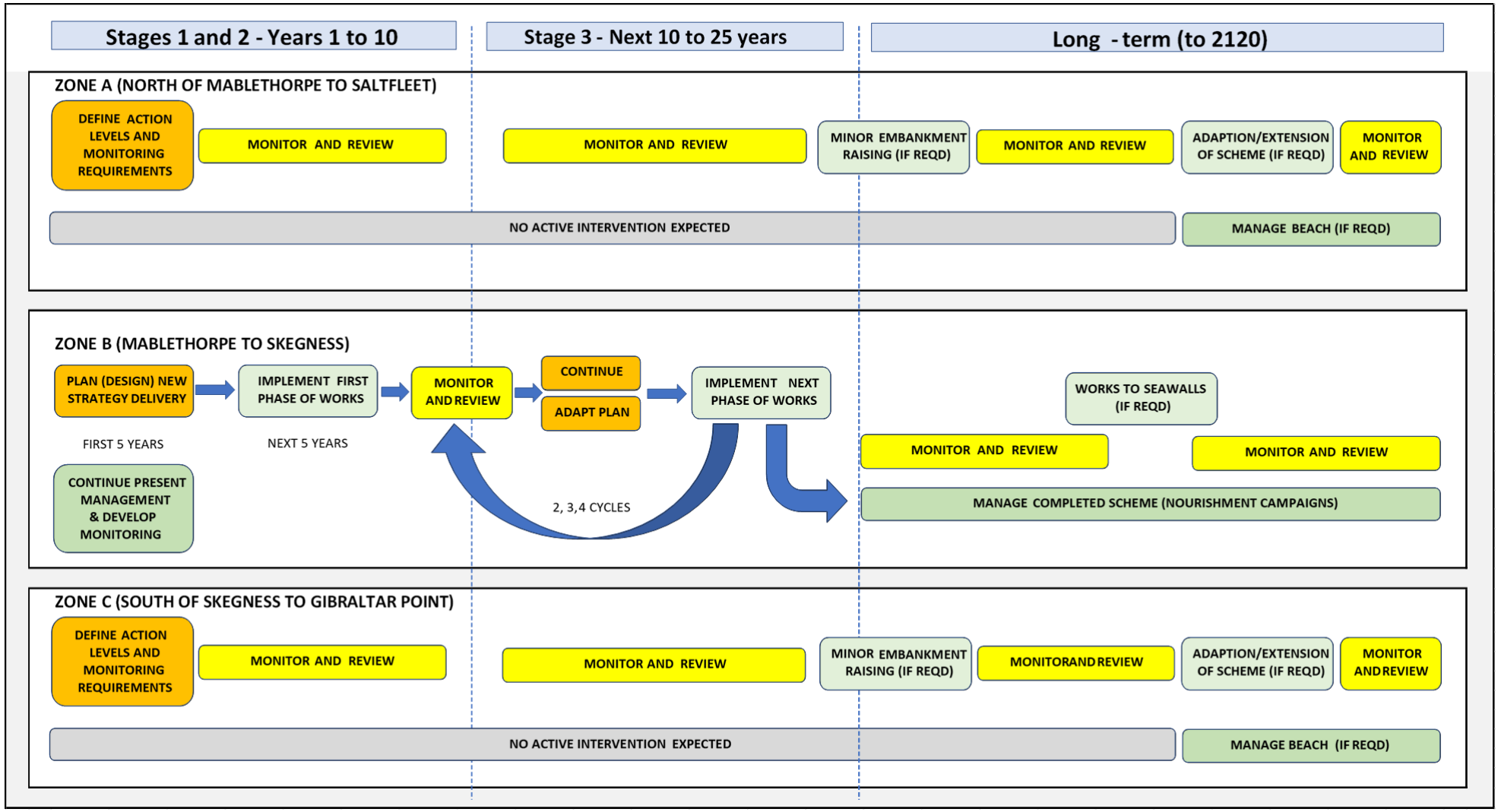


Figure 2.6: Overview of strategy delivery

2.6.2 Strategy delivery

Funding and approvals for the present nourishment campaigns are in place up to and including 2020, while agreement to this new strategy is obtained. Delivery of the new strategy will commence from 2021 in accordance with the process and actions set out in Figure 2.6. A phased approach to its implementation is necessary, transitioning from present practice to the new management approach being fully operational, and several aspects of that approach will need to be developed before the first changes are introduced.

Stage 1: short term (2021 – 2025)

The initial design and obtaining the necessary approvals and higher levels of funding required for the change in approach recommended in this strategy (i.e. the introduction of rock structures in the medium term – scenario 2 for the purposes of this SEA) could take up to five years to complete. Actions required in the short term would include:

- engagement with local stakeholders and authorities to establish potential locations for the structures;
- early supplier engagement to develop detailed estimates;
- coastal modelling of structures' orientation and layouts;
- setting up of environmental baselines and scoping of future monitoring requirements;
- identification of review points and parameters for monitoring performance.

While this takes place, management of flood risk needs to continue, and permissions and approvals to continue with the present nourishment campaigns will be secured.

The present management in Zone B (Mablethorpe (Meers Bank) to Skegness (Lifeboat Avenue)) will be continued, with no active invention planned in Zones A and C, consistent with SMP policy. This will involve the annual nourishment of the fronting beaches in Zone B with sand dredged from offshore donor sites to sustain the required standard of protection in accordance with sea level rise, and protect the landward hard (e.g. sea walls, embankments) and soft (e.g. sand dunes) defences, which will be maintained as required. This will also include the additional measures that comprise the present Lincolnshire Beach Management (LBM) project – including the removal of any remaining damaged or non-functional timber groynes encountered; potential sand recycling, if required; monitoring of beach levels; and annual monitoring of environmental parameters.

Stage 2: early medium term (2026 – 2031)

Continuing the present management approach (i.e. scenario 1 for the purpose of this SEA) across the strategy area would require little change (in terms of funding or licensing), although future approvals and assents will have to meet the requirements of any future legislation.

Subject to the availability of higher levels of funding, the implementation of a combination of rock control structures (most likely rock groynes but with the potential inclusion of larger fishtail structures) and a reduced level of nourishment (i.e. scenario 2 for the purpose of this SEA) is identified as the preferred strategic approach to deliver flood risk management in the medium to long term in Zone B. This is the area of most rapid beach loss and thus the focus of previous and ongoing nourishment operations.

Within this stage there is an opportunity for a first phase scheme to be introduced, installing a small number of rock groynes and monitoring their performance and influence on sand transport at a suitable location. This would have considerable benefits, as monitoring data would feed back to calibrate the modelling and would inform the detailed design of the next phase of works in terms of structure length, height and spacing. This initial scheme would also help in assessing the environmental outcomes prior to rolling out a full strategy.

Stage 3: later medium term (2031 – 2055)

Following the first phase scheme, the proposed structures would then be introduced in phases, with an immediate focus on erosion 'hotspots' (refer to Figure 2.3). Through continued monitoring of scheme delivery and performance, the configuration of rock structures and extents of nourishment can be refined for subsequent phases and it may be possible to make further efficiencies and savings in future years. The timing and precise actions will therefore be established iteratively; the remaining works could be implemented relatively quickly (within 10 to 15 years) or comprise a few repetitions of the initial phase of works outlined above.

As part of the planning and design of the strategy, performance criteria relating to beach state, flood risk, and maintaining habitats will not only be established for Zone B but also for Zone A (north of Mablethorpe) and Zone C (south of Skegness). These will be defined to both optimise the interventions in Zone B, and to identify if and when any structures/direct nourishment might need to be introduced in those areas, although that is not currently expected to be required for several decades.

Any raising of the seawalls or embankments behind the beach to accommodate climate change effects is not presently anticipated to be required for several decades, depending on the actual rate of sea level rise, and will also be subject to long term monitoring.

In the later medium term in Zones A and C, the preferred policy is to hold the defences in their current position (HECAG, 2010). The solution would comprise a continuation of no active intervention but with a potential increase in monitoring activity until climate change triggers dictate that some intervention will be required. Currently beach level monitoring is carried out in these zones in association with the Environment Agency's beach monitoring programme. Future monitoring may involve more regular inspections of the coastal marsh and dune frontages. Interventions may include provision of some new embankments and raising of the existing defences. It should be noted that Zone C is more susceptible to interventions than Zone B. Zone A, by comparison, is more influenced by sediment input from futher north (Humber/Holderness).

Long term management (2056 – 2120)

Following completion of the transition to the planned management approach, i.e. once all control structures are completed and the modified beach nourishment regime is established, actions in the long term will generally comprise lesser volume/less frequent beach nourishment operations, and continual monitoring against the prescribed performance criteria to inform those requirements.

It is only at this time some interventions in Zones A and C might become necessary in response to long term climate change triggers, i.e. measurable changes in sea level or storm damage to the marsh and dune systems. Any interventions involving works on the foreshore (such as Zone B type interventions) would require considerable early consultation with respect to the environmental designations, although it would be preferable to be prepared to do something in advance of any potential emergency response.

Some works to the seawalls to better accommodate sea level rise may also be required.

Future changes to the strategic approach, which retains flexibility and adaptability, might be triggered by changes to local requirements and additional funding, but could also result from changes to legislation or environmental issues such as climate change. At any such trigger point the approach taken will be to review the approach, to make sure the reaction is appropriate, and to consult to seek views on major changes.

2.7 Environmental opportunities

Potential opportunities to deliver improved environmental outcomes along the Lincolnshire coast either directly as part of the implementation of the strategy, or via the provision of support for other Environment Agency schemes or stakeholder initiatives within the wider area are being sought. Specific opportunities (e.g. the potential for the design of new structures to provide habitat for colonisation by marine organisms increasing the biodiversity of the coastal waters; potential for imrprovement of recreation/amenity features) are included within the scope of the SEA and are identified in Section 6 – with further actions recommended for future implementation at a project level.

Under current funding rules, environmental outcomes must either be integrated into flood and coastal risk management projects or relate to clear legal obligations which cannot be achieved through an integrated project. The level of grant in aid that may be spent on flood and coastal risk management projects is formulated by the Government's partnership funding policy.

Additional funding can only be obtained for specific environmental outcomes (i.e. those defined below as Outcome Measures (OM4a, b & c)) and although other environmental outcomes must be reported (OM4d-e) (e.g. kilometres of water body opened up to fish/eel passage), no specific funding is available.

- OM4a: Water dependent habitat - area (in hectares) of water-dependent habitat created or improved to help meet the objectives of the EU WFD.
- OM4b: Intertidal habitat - area (in hectares) intertidal habitat created to help meet the objectives of WFD for areas protected under the EU Habitats/Birds Directives.
- OM4c: Protected rivers - length (in kilometres) of rivers protected under the EU Habitats/Birds Directive improved to help meet the objectives of WFD.
- OM4d: Kilometres of WFD water body enhanced through FCRM.
- OM4e: Kilometres of water body opened up to fish and/or eel passage through FCRM.
- OM4f: Kilometres of river habitat enhanced (including SSSI) through FCRM.
- OM4g: Hectares of habitat (including SSSI) enhanced through FCRM.
- OM4h: Hectares of habitat created through FCRM.

However, although no additional specific funding is available, we can "value" other environmental outcomes[13] (e.g. creation of new priority habitat (defined as a Habitat of Principal Importance under the Natural Environment and Rural Communities Act), other than freshwater or intertidal), and include as part of the overall cost-benefit of a scheme (as part of Outcome Measure 1) to generate additional benefits and limited funding.

Where good opportunities exist, the Environment Agency policy is to actively identify partners who can contribute to the costs of delivering these additional environmental outcomes. Engagement with stakeholders during the development of the strategy sought to identify potential high level opportunities although no specific opportunities have been identified to date. However, the Environment Agency will continue to liaise with our environmental and community stakeholders throughout the development of any works arising, and any opportunities identified will be delivered in partnership with these stakeholders where funding permits.

[13] The FCRM partnership funding calculator identifies environmental outcomes relating to: kilometres of river protected or improved through FCRM; hectares of habitat protected or improved through FCRM; hectares of habitat created through FCRM. Many of these measures do not directly attract specific funding, but can be included within the overall cost benefit of a scheme under Outcome Measure 1 by valuing the environmental/ecosystem service benefits of the environmental outcome to generate some limited additional benefits and funding.

3. Baseline conditions

3.1 Introduction

This section describes our current understanding of the environmental characteristics of the strategy study area, both at the present time and into the future in the absence of the strategy. This section also identifies the key strategic environmental issues, constraints and opportunities, which provide the basis from which the scope of the SEA and the framework of SEA objectives was identified, as described in Section 4.

The strategy study area includes the coastal frontage, offshore waters and inland areas that have the potential to be directly affected, positively or negatively, by the strategy as described in Section 2.1. However, it is important to note that for the purposes of the SEA, potential effects on sensitive features located outside this strategy area are also considered within the assessment where appropriate.

The SEA Regulations identify the environmental receptors/topics that must be initially considered for all SEAs. This list provides a starting point from which these can be scoped out of, or in to, the SEA, depending on whether or not they are considered likely to affect or be affected by the strategy. Table 3.1 identifies the topics required to be considered as defined by Schedule 1 of the SEA Regulations and how those are considered within this SEA.

This environmental baseline was initially defined at the scoping stage of the SEA in summer 2016 and reflects any feedback/updates identified during consultation on the proposed scope of the SEA, as described in Section 5, and any relevant updates required.

Table 3.1: Topics considered in this SEA.

Topics listed in the SEA Regulations	How described in this SEA
Population and human health	Population, health and economy
Material assets	Material assets
Biodiversity, flora and fauna	Biodiversity, flora and fauna
Soil	Geology and soils; coastal processes and geomorphology
Water	Water and hydromorphology
Air; climatic factors	Air and climatic factors
Cultural, architectural and archaeological heritage	Historic environment
Landscape	Landscape and visual amenity
Inter-relationship between the above factors	To be considered for all topics within the SEA

The strategy is influenced in various ways by other plans or programmes, or by external environmental protection objectives such as those laid down in policies or legislation. Section 3.4 identifies the key policies, plans and strategies that are relevant to the strategy area and have informed the SEA process. Understanding the relationships between these other plans and this strategy and embedding requirements within the proposed SEA objectives (see Table 5.1) enables advantage to be taken of potential synergies and to deal with any inconsistencies and constraints.

3.2 Data sources

Baseline data for the strategy area has been captured incrementally through the various environmental assessments completed for the Lincshore strategy/scheme over the past 20+ years.

The baseline data gathered to date to inform this SEA is primarily based on the Environmental Statement and associated HRA (Environment Agency, 2016) prepared in support of the marine licence for the Lincshore 2016-2020 beach nourishment scheme which covered a similar spatial area to the strategy area. This has been supplemented with the following additional updated data, including the programme of annual environmental monitoring undertaken for the Lincshore scheme, consultation feedback on the 2016 Lincshore marine licence application, and consultation feedback and data received during the scoping stage of this SEA and other stakeholder engagement activities:

- magic.defra.gov.uk (accessed in May 2016; reviewed in July 2018).
- Environment Agency Catchment Data Explorer: https://environment.data.gov.uk/catchment-planning/ (accessed in May 2016; reviewed in July 2018).
- Data relating to non-statutory biological and geological sites obtained from the Greater Lincolnshire Nature Partnership in March 2016, supplemented in November 2016/17.
- Lincshore 2010-2017 Environmental Annual Monitoring Report: 2017 (Environment Agency, 2018).
- East Lindsey District Council Local Plan (adopted 2018) – Core Strategy and supporting documents.
- Ecological survey data received from Lincolnshire Wildlife Trust in 2017 relating to the biodiversity value of the coastal frontage.
- Heritage Gateway (https://www.heritagegateway.org.uk/gateway/); Historic Environment Record data received in 2017 from Lincolnshire County Council Archaeology Service and the Historic England Intertidal and Coastal Peat Database.

Details of the specific data sources used to define the baseline conditions are provided in Appendix E for each topic proposed to be considered within this assessment.

Baseline information provides the basis for predicting effects on the environment and helps to identify any relevant environmental trends and existing problems that may be affected by the strategy. The baseline information presented in this section is at a strategic level, appropriate to the scale of the study. Key assumptions, gaps and uncertainties associated with the data used for this assessment are set out in Section 4.5.

As highlighted above, a programme of environmental monitoring has been undertaken at selected locations along the coastal frontage since the early 1990s to establish the impacts of previous nourishment on the natural physical processes and ecology of this area (see Section 6.13 for details). The core monitoring programme seeks to identify any potential effects on marine fauna (benthic and epibenthic invertebrates) inhabiting the beach, near shore sediments and along the coastline, and to consider any potential adverse effects on fisheries, in particular the inshore brown shrimp fishery. Proposals for the monitoring of additional parameters to improve our understanding and assessment of future changes along the shoreline are detailed in the Lincshore 2016-2020 Environmental Statement. The data available from previous studies and the ongoing monitoring programme has been used to inform this SEA, where appropriate.

3.3 Baseline environmental characteristics

The key environmental characteristics of the strategy area, both now and in the future, and the associated issues, constraints and opportunities relating to the proposed strategy are summarised in Table 3.2 and shown on Figures G.1 to G.9 in Appendix G; with further details in Appendix F. These address each of the topics described in Table 3.1.

The timescales for the predicted future changes in the absence of the proposed strategy described in Table 3.2 are uncertain. It is likely that changes would start to occur in the short-term, following cessation of works, as beach levels reduce and the levels of risk increase. A potential breach or failure of existing defences is likely to occur in the medium to long-term, resulting in more drastic changes and implications.

Table 3.2: Key characteristics of strategy area at present, and in the future, and key issues, constraints and opportunities relating to the proposed strategy

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
Population, health and economy (refer to Figure G.1)		
• Approximately 22,000[14] residential and commercial properties, approximately 24,500 caravans, utilities and infrastructure are at risk from tidal flooding (no flood defences; based on a flood with a 0.5% annual chance of occurring). • Increasing population within Lincolnshire (2011 census), primarily in the 60-64 age group, with increasing pressure on critical services. Coastal towns and villages are popular retirement destinations. • Mablethorpe and Skegness contain localised areas of high social deprivation. • Traditional lively seaside holiday offer at resorts in Skegness and Mablethorpe and numerous holiday parks/tourism businesses; with wilder/more unspoilt tourist destinations to the north of Mablethorpe, between Sutton-on-Sea and Chapel St Leonards and south of Skegness. • Recreational assets along the coastal frontage include the beaches (with good/excellent water quality), footpaths/promenades, including the newly opened (February 2019) England Coast Path between Skegness and Mablethorpe, cycle ways, recreational areas/sports grounds/golf courses and wildlife reserves, including the	• Without adequate flood defences and with increasing risk, residential and commercial properties, caravans, utilities and infrastructure could be permanently cut-off and flooded, and there would be detrimental impacts on existing land uses, notably agricultural land. It is likely that people would need to move out of the floodplain, resulting in the abandonment and subsequent cost of clearance of property and infrastructure (including access to emergency services such as the RNLI stations). There would be a potential risk to life and associated adverse impacts on human health and economy. • Such significant changes to the study area are likely to limit community viability, inward investment and regeneration, business continuity and tourism, and in the absence of a strategy there may be no mechanism through which communities are informed of the changes and climate change adaptation. • The existing recreational and tourism resource of the strategy area would be	• Increasing flood risk and associated issues relating to safety, security and social/physical wellbeing for people living in the tidal floodplain needs to be managed. • A growing population of predominantly elderly people at increasing risk from tidal flooding and increasing development pressure (and pressure on existing services) in the tidal floodplain. • Problems at Skegness and Mablethorpe associated with a seasonal tourism economy and pockets of social deprivation are compounded by increasing coastal flood risk. At these coastal settlements, potential opportunities may exist for partnership working to overcome deprivation through regeneration and to reinvigorate the local economy. • The viability of isolated and dispersed settlements and associated communities at risk from flooding needs to be considered. • Existing flood risk to key recreational facilities and tourist resorts along the coastal frontage, will be significantly affected by the failure of the existing defences. • The presence of a sandy beach is a key feature for the traditional tourism within the busier tourist

[14] Based on 2009 property counts, assuming that subsequent new developments are sufficient in terms of their own flood mitigation provision.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
Coastal Country Park. Opportunities for informal recreation throughout e.g. bird watching, angling, picnicking, swimming, walking. • Local economy based on agriculture and seasonal tourism, with contributions from fisheries and service industries. The adopted ELDC Local Plan is seeking to grow and diversify local economy. • Locally important fisheries and shellfisheries within the strategy area and to the south in to The Wash, most notably for shrimp and mussels and cockle beds.	significantly affected through the loss of the amenity beach and promenade along the seafront, and the high flood risk posed to existing recreational assets and tourism businesses in the hinterland of the defences (including the amusement park at Mablethorpe, Butlin's Resort and the Fantasy Island complex). These impacts would affect the tourist industry on the Lincolnshire coast, which is the main visitor attraction in the area. • Fishing activities are likely to continue although there would be increasing difficulty in launching fishing vessels along the coastal frontage as beaches erode and potentially disappear in the long-term.	resorts, and its loss would have significant impacts on the 'seasonal' tourist industry in some areas. The shoreline flood defences also provide a recreational amenity along the promenades. • The proximity of the amenity facilities to the sea is considered an important element in maintaining the attractiveness of the tourist resorts, particularly in Skegness and Mablethorpe. • There are opportunities to diversify the tourist industry by providing new opportunities for more all year round tourism and to create more sustainable tourism and eco/nature tourism in some areas (e.g. developing nature reserves through habitat creation and within the Coastal Country Park). Diversification and expansion of the tourism offer is supported by planning policy within the adopted ELDC Local Plan. • Any changes to flood risk management options could affect coastal processes and the movement/suspension of sediment that presents risks to water quality and shellfisheries to the south of the strategy area. • The presence of new flood defence structures has the potential to limit the ability to launch fishing vessels from beaches in the study area.
Material assets (refer to Figure G.1)		
• No motorways within the strategy area or rail connections to the coastal frontage.	• Given the dispersed settlement pattern and the lack of alternative transport infrastructure, the existing heavy reliance on road transport and private car ownership will continue with increased	• The local road network is at risk from flooding and the effects on access/connectivity between settlements needs to be considered during the development of the strategy.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
• Network of 'A' and local roads within the strategy area are critical to providing connectivity between the dispersed network of settlements. • Critical infrastructure within the strategy area includes the former Theddlethorpe gas terminal (closed in 2018), onshore cable landings/connections for offshore windfarms (including the consented Triton Knoll wind farm for which the landfall infrastructure is being constructed just north of Anderby Creek), lifeboat access at Mablethorpe, and water/power infrastructure. A cable link, the "Viking Link" is proposed between Lincolnshire and Revsing in Denmark to enable the import and export of power with mainland Europe. The preferred landing point on the Lincolnshire coast is at Boygrift adjacent to Sandilands Golf Course. • Present approach of beach nourishment relies on availability of sand of suitable grade from licensed offshore dredging sites.	population growth adding to vehicular traffic. • When the defences fail in the medium term, the road network and access roads would become unusable and communities would have to move out of the tidal floodplain. • Climate change and sea level rise will increase tidal flooding to critical infrastructure at risk along the coast, affecting the viability/functioning of this infrastructure with impacts on local and the wider population.	• Need to consider the flood risk to existing services and power/utilities infrastructure and effects on the local population. • Changes in flood risk management actions could affect the cable landings of known or proposed wind farms or the proposed Viking cable link. • Opportunities exist to consider raising roads/relocating infrastructure in the hinterland to enable adaptation to flooding. • Uncertain availability of finite construction/nourishment materials (e.g. dredged sand of the required grade from offshore banks) in the future.
Biodiversity, flora and fauna (refer to Figures G.2 to G.4)		
Internationally designated nature conservation sites situated to the north and south of the strategy area, including: • Saltfleetby-Theddlethorpe Dunes and Gibraltar Point Special Area of Conservation (SAC) • Gibraltar Point Special Protection Area (SPA) and Ramsar site • The Wash SPA and Ramsar site	• Climate change and associated sea level rise poses continuing and new challenges to the management of designated sites, habitats and species. • With overtopping and eventual failure of the defences, there would be a loss of terrestrial and freshwater habitats in the hinterland due to increased water levels and salinity, and the potential creation of	• The strategy needs to maintain (and improve, where possible) the present condition of internationally, nationally and locally designated sites, subject to natural change. However, the changes occurring are not clearly understood and many of these changes occur outside of the strategy area as a result of wider interactions with The Wash and the open coast offshore. • Replacement habitat is likely to be required for any predicted losses of habitat within national or locally

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
• The Wash and North Norfolk Coast SAC • Inner Dowsing, Race Bank and North Ridge SAC • Greater Wash SPA • The Humber Estuary SPA, SAC and Ramsar site Nationally designated nature conservation sites situated within and to the north and south of the strategy area, including: • Saltfleetby-Theddlethorpe Dunes Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR) • Gibraltar Point SSSI and NNR • The Wash SSSI and NNR • Sea Bank Clay Pits SSSI Note that the recommended Lincs Belt Marine Conservation Zone (MCZ) is no longer under consideration for potential designation. Locally designated nature conservation sites situated within the strategy area, including: • 39 Local Wildlife Sites (LWS); with those along the frontage including: Anderby Creek Sand Dunes; Croft Marsh, Gibraltar Point; Moggs Eye Sea Bank Ponds; Saltfleetby to Theddlethorpe Dunes Nature Reserve; Huttoft Dykes Green Lane; Steeping Marsh; Lagoon Walk Dunes; Chapel Point Dunes, South; Sandilands Golf Course and Dunes; Huttoft Car Terrace to Marsh	intertidal habitat in isolated pockets of the hinterland. • There would be changes to the coastal geomorphology of the shoreline, and coastal sediment processes, which could affect coastal ecology, marine ecology and fisheries, within and outside designated sites.	designated sites along the coastal frontage if parts of the coast are realigned. • Opportunity to provide a more sustainable network for wildlife along the coastline that benefits people and wildlife. • Changes in the alignment of the coastline for habitat creation (including grazing marsh and intertidal habitats), would contribute to the pro-active delivery of government biodiversity targets, environmental Outcome Measures, potential for environmental education and marine tourism. • Opportunity to improve habitat (e.g. through beach morphology/dune management, vegetation planting seaward of defences) while managing flood risk. Vegetation can be used in front of defences to help maintain and increase biodiversity. Impacts on designated habitats, habitats of principal importance and dependent species need to be considered and may arise from: • Direct habitat loss or damage due to the presence of new or extended hard flood defence structures e.g. from encroachment into the intertidal/subtidal area or from change in reflectivity of sea defence structures. • Temporary works causing damage to the intertidal area during any proposed construction or construction noise/vibration affecting designated interest features through disturbance/displacement.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
Yard Dunes; Marsh Yard to Anderby Creek Dunes; Wolla Bank South; Chapel Six Marshes; Chapel Point Dunes, North; Chapel Pit Nature Reserve (non-SSSI); Sea View Walk, Skegness. • 47 Sites of Nature Conservation Importance (SNCI), where not yet designated as LWSs; 17 Lincolnshire Wildlife Trust Reserves and one Roadside Nature Reserve at Huttoft. Habitats and Species of Principal Importance (designated under the Natural Environment and Rural Communities (NERC) Act 2006) present within the strategy area; including two areas of ancient woodland. Marine habitats, flora and fauna present within the strategy area and the zone of influence of the strategy, including the potential presence of *Sabellaria spinulosa* within the seabed immediately offshore, shellfisheries within The Wash and spawning/nursery grounds for fish species (Environment Agency, 2018). There are significant initiatives to promote biodiversity along the coastal frontage including the Coastal Grazing Marshes Project and the Coastal Country Park. Ecological survey data collected by LWT for the coastal frontage indicates the considerable ecological value of the landward habitats for wetland birds (e.g. Steel *et al*., 2013)[15].		• Habitat change along the coastline as a result of any changes from the present approach of beach nourishment. • Rapid changes in coastal processes and geomorphology (and effects on intertidal and sublittoral invertebrate/fish communities) that do not allow the designated sites and their qualifying interests to adapt over time or that accelerate erosion. • Changes in flood risk to freshwater and terrestrial habitats and species within the flood hazard zone as a result of the incursion of tidal waters if the level of flood risk is increased. • Continued beach nourishment may affect dune formation.

[15] Steel, C, Manning, C and Wardle, R (2013) *Creating and Managing Grassland for Breeding Waders on the Lincolnsire Coastal Grazing Marshes*. In Practice. Chartered Institute of Ecology and Environmental Management. Dec 2013. Edition 82.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
Soil, geology and geomorphology (refer to Figures G.2 and G.3)		
• Nationally important earth heritage sites, designated for their geological or geomorphological interest within the strategy area, include: the Chapel Point-Wolla Bank SSSI and Gibraltar Point SSSI. • Locally designated earth heritage sites including Regionally Important Geological and Geomorphological Sites (RIGS) within the strategy area, include: Huttoft Bank Foreshore; Sutton on Sea Foreshore; Vickers Point Foreshore; Wolla Bank Foreshore. • Beaches are underlain by boulder clay. Peat and clay exposures of geological interest at various points along the foreshore. • Solid geology is Cretaceous Chalk, with a small outcrop of resistant sandstone to the south. • More than 20 licensed landfill sites within the strategy area at risk from flooding. • Limited previous industrial development within the strategy area, but pockets of potentially contaminated land present. A brownfield land register has been prepared by ELDC. • Macrotidal system with a net southerly longshore transport system with two main sediment transport pathways: southerly longshore transport roughly parallel to the coastline; and via a channel between Silver Pit and The Wash. Offshore banks also feed sediment towards the coast.	• Increased wave energy and coastal surges are likely to exacerbate the erosion of the existing beach. • Losses of beach material will expose the underlying peat and clay. • Reduction in the availability and movement of material from within the coastal frontage of the strategy area to areas downdrift, with resulting changes in sedimentology and geomorphology. • Eventual failure of the defences in the absence of a strategy would likely result in the flooding of areas potentially contaminated or containing landfills, with associated negative impacts on visual amenity, human health, water quality and designated conservation sites and WFD objectives. • Due to existing infrastructure and continued presence of failing defences it is unlikely that a natural looking or naturally functioning coastline would develop for a long time.	• Flood risk management actions have the potential to accelerate the erosion of any nationally or locally designated earth heritage sites or peat/clay exposures of value (e.g. by allowing a lowering of beach levels), but also present an opportunity to provide greater protection (e.g. by maintaining or increasing existing beach levels). • Failure of defences and rising sea levels would result in the flooding of contaminated sites and potentially, landfills, presenting a pollution risk with associated impacts on water quality, aesthetics, human health and ecology. • Flood risk management actions have the potential to affect the volume and movement of sediment, with resulting changes in sedimentology and geomorphology along the coastal frontage and the areas downdrift.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
• Present sedimentology of the coastal frontage directly influenced by the beach nourishment scheme over past 20+ years.		
Land use and management (refer to Figure G.5)		
• Agriculture is the dominant land use within the strategy area, much of which is classified as high grade (Grades 1 to 3a).	• There would be a significant reduction in the overall area of land available for agriculture as a result of sea level rise and flooding. • Current Government policy promotes the need for flexibility in the nature and type of future agricultural production. Drivers likely to affect future production include price of land and crops (including wheat), climate change, increased emphasis on self-sufficiency of food production and an increase in the production of biofuels.	• Areas of high grade agricultural land present in the tidal floodplain, with flood risk reduced by the coastal defences. Given the importance of agriculture to the local economy within the strategy area, the strategy should seek to maintain existing practices, while accepting that there may need to be flexibility in the nature and type of future agricultural production.
Water and hydromorphology (refer to Figure G.6)		
• Three coastal water bodies, two transitional water bodies, 11 river water bodies (all drainage channels or managed watercourses) and one groundwater body within the strategy area, as defined under the WFD; the majority of which require improvements to meet their required objectives. The strategy area falls within the Anglian River Basin District and the River Basin Management Plan (Environment Agency 2015) sets out the actions required to enable the water bodies to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP).	• The programme of measures required to achieve good ecological and chemical status and/or potential under the WFD by 2027 will drive improvements in the water environment in the short-term and provide for the maintenance of this status into future years. • The WFD requires all natural water bodies to achieve both good chemical status and GES or GEP for artificial and heavily modified water bodies.	• Strategic coastal risk management actions must not constrain the achievement of good ecological and chemical status/potential for all water bodies in the study area. Changes in coastal processes can cause sedimentation, which decreases the water quality for shellfisheries and thus affect objectives set by the WFD. • Opportunity to deliver mitigation identified in the Anglian RBMP and to contribute to GEP/GES by reducing lengths of, or removing flood defences to

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
• The WFD also identifies water-related Protected Areas in the strategy area, which may require the achievement of more stringent standards than GES/GEP to meet the requirements of other, related, EU Directives. Those within the strategy area, which will require further consideration during the development of the strategy include those designated under the following Directives: Habitats and Conservation of Wild Birds Directives; Shellfish Directive; Drinking Water Directive; Bathing Waters Directive; Nitrates Directive; and Urban Waste Water Treatment Directive. • Several Groundwater Source Protection Zones (SPZs) are present landward of Mablethorpe and Ingoldmells.	• Water resources within the study area will be under increasing pressure from the ageing and growing population and there will be increased demand for wastewater treatment and drinking water. • Increased flood risk would affect water supply or treatment facilities in the hinterland of the defences, resulting in loss of service or contamination of water supplies.	reduce hydromorphological modifications to the coastal water body. • Strategic flood risk management must not constrain the achievement of WFD (and Protected Area) objectives e.g. changes in coastal processes affecting water quality and biological parameters or through the release of pollutants into the water column. • Flooding of sewerage systems and contaminated land presents a pollution risk to receiving water bodies.
Air and climatic factors		
• Given the largely rural nature of the strategy area, there are no significant air quality issues and sources of air pollution are limited to local emissions from vehicular traffic (particularly along the A16, A158 and A52). No Air Quality Management Areas declared. • Future climate change predictions predict rises in sea levels and increased storm surge wave activity, in accordance with latest guidance. • It is recognised by ELDC (Core Strategy, 2018) that the key issue to delivering sustainable development on the coast is climate change and	• No significant changes in air quality anticipated in the future. • In the long term, wetter winters and an increase in sea levels and a potential increase in the frequency of storms, could increase the frequency, extent and severity of flooding in the study area resulting in flooding of, and damage to, properties and agricultural land.	• There are no significant concerns relating to air quality within the study area. • Best available climate change predictions will be used to quantify potential changes in the short to long-term and identify future impacts on flood and coastal risk. The strategy should seek to accommodate future climate change and enable adaptation if required.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
the anticipated impacts it will have on future sea levels and the increasing threat of tidal flooding.		
Historic environment (refer to Figures G.7 to G.9 (a-d))		
• The historic environment of the strategy area encompasses: traditional seaside towns[16], with associated heritage value, including Conservation Areas; the contribution of the historic environment to landscape[17] and seascape[18]; and numerous designated and non-designated assets. • In terms of designated assets, the strategy area contains several at risk from flooding: 12 Scheduled Monuments; more than 90 listed buildings; three Conservation Areas; and two Registered Parks and Gardens. • The strategy area also includes a number of undesignated assets (e.g. wreck sites) listed on the Lincolnshire Historic Environment Record (HER). As agreed with the LCC Historic Environment Officer, a high level screening assessment of assets potentially affected by the strategy was undertaken to inform the SEA. • The peat exposures along the shoreline are considered by Historic England to be of palaeo-environmental value. These provide a record of sea level and coastal changes and preserve buried features that help us to understand how	• The character of the seaside towns are likely to change affecting the character of Conservation Areas as well as individual buildings. This could affect their historic attraction and ability to provide a basis for heritage-based tourism and improving prosperity. • The archaeology and historic environment of the study area is a finite resource and will be increasingly threatened by physical changes to the coast or changes in flood risk in the short to long term, including the exposure and potential erosion of assets covered at present. The management of existing designated or undesignated assets and previously unknown archaeological assets will be required.	• The historic environment, including the coastal heritage of the seaside towns, historic landscape and archaeology, of the strategy area provides significant benefits to the local community particularly the aspects of wellbeing and a "sense of place", with additional economic benefits from heritage tourism. These places will change and evolve and it is important to reflect on their character and identify what should be retained and enhanced. • Specific identified designated and non-designated assets are currently at risk from flooding. This could result in the unplanned loss of such assets, reduction in heritage significance, and/or loss of public access and enjoyment of such assets. • The present beach levels that cover the peat exposures and other assets of palaeoenvironmental value and archaeological interest along the coast provide protection from erosion. • Consideration should be given to the potential to reduce the risk of flooding to existing archaeological or architectural assets, in historic centres (in particular, Conservation Areas) and at individual

[16] Williams, P (2013) The English Seaside. https://historicengland.org.uk/images-books/publications/english-seaside/
[17] Lincolnshire County Council and English Heritage (2011) *The Historic Character of the County of Lincolnshire.*
[18] URS/Scott Wilson (2011) *Seascape Characterisation around the English Coast (Marine Plan Areas 3 and 4 and Part of Area 6 Pilot Study).* Natural England Commissioned Report NECR106. Description of key characteristics updated in Marine Management Organisation (2012) Seascape character assessment. East Inshore and East Offshore marine plan areas.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
the habitats and landscape of this area and their use by people change over a significant period. • Potential for the presence of previously unknown archaeological assets along the coastline. A Rapid Coastal Zone Assessment (RCZA) undertaken in 2007 provides an assessment of the archaeological potential of the coastline within the strategy area.		sites dispersed throughout the study area. Consideration should also be given to the effects on the character and setting of designated heritage assets and their wider benefits to townscape heritage. • Coastal risk management measures may be influenced by the need to protect the setting of areas of existing archaeological and architectural value. Opportunity to provide improved flood protection to identified significant heritage assets in the long-term.
Landscape and visual amenity		
• No landscape designations within the strategy area. • Baseline landscape character of the strategy area described in the 2009 ELDC landscape character assessment; forming part of the Tetney Lock to Skegness Coastal Outmarsh (J1) and the Donna Nook to Gibraltar Point Naturalistic Coast (K1) character areas. • Seascape character of the strategy area (as part of the East Midlands Coastal Waters character area) is described by Natural England (URS/Scott Wilson, 2011, as updated in MMO 2012)[19].	• Landscape character, both present and historic, and visual amenity would change significantly in the absence of a strategy in the medium to long-term as increased tidal flooding would dramatically alter the coastal landscape. Initial changes would involve the gradual narrowing and loss of the amenity beaches. On failure of the coastal defences, the frontage (and associated seascape character) would revert to a retreating beachfront/coastline with unprotected buildings and infrastructure in the hinterland of the breached	• Engineering constraints mean that the new flood and coastal risk management structures cannot be designed in keeping with the existing landscape and seascape character. • Where possible, the placement of any new structures should be sited to avoid affecting sensitive landscapes and visual amenity within the strategy area. • The scale of any coastal risk management structures should ensure the key wide and distant views, and relationship with the horizon, remain intact.

[19] URS/Scott Wilson (2011) *Seascape Characterisation around the English Coast (Marine Plan Areas 3 and 4 and Part of Area 6 Pilot Study).* Natural England Commissioned Report NECR106. Description of key characteristics updated in Marine Management Organisation (2012) Seascape character assessment. East Inshore and East Offshore marine plan areas.

Summary of existing conditions	Future changes in the absence of the strategy	Key issues, constraints and opportunities
• Historic landscape described in the Historic Landscape Characterisation (HLC) project (LCC & English Heritage, 2011) and the strategy area forms part of the Grazing Marshes Regional Character Area (RCA 8). • The Coastal Country Park is identified by ELDC as an area of local landscape value. • Visual amenity along the coastal frontage is important for residents, tourists and other coast/beach users.	defences being either washed away or flooded.	• Opportunities to enhance the landscape and seascape character and attractiveness of the coastal and landward areas by working in partnerships with the local authority or outside organisations such as Structures on the Edge (SOTE) to provide wider landscape enhancements. • The strategy will need to consider cumulative effects on landscape and seascape character and visual amenity resulting from a combination of coastal risk management measures and any other proposals within the strategy area.

3.4 Links to other plans and strategies

3.4.1 Introduction

This section considers and briefly describes the key external development planning, water management and economic development plans and strategies that will influence, or will be influenced by, the proposed strategy. The key themes and objectives of these plans have influenced the identified scope and objectives of this SEA (Tables 4.1 and 4.2) and have been further considered during the assessment of in-combination effects in Section 6.12.

Relevant EU Directives, national legislation, and policy requirements have also been considered in developing the identified scope (see Section 4.2) and associated objectives and assessment criteria (see Section 4.3) for each of the topics considered. Relevant local plans and initiatives identified by stakeholders during scoping and other consultation/engagement activities have also been reviewed, and where appropriate, are considered within the assessment.

Consideration of the UK 25 Year Environment Plan (Defra, 2018) has also been made to ensure that the objectives of the strategy and the assessment criteria used to identify the strategy proposals are both consistent with this and contribute where possible. This plan identifies goals and targets to improve the UK environment and achieve: clean air; clean and plentiful water; thriving plants and wildlife; reductions in the risks of harm from environmental hazards; sustainable and efficient use of natural resources; enhancement of the beauty, heritage and engagement with the natural environment; minimisation of waste; mitigation and adaptation to climate change; enhancement of biosecurity and the management of exposure to chemicals. Where relevant, this strategy seeks to avoid/minimise harm and contribute to the delivery of environmental improvements in accordance with the Environment Plan.

3.4.2 Spatial planning and development framework

In terms of development planning and regulation, the terrestrial parts of the strategy area fall within the jurisdiction of LCC and ELDC, and below Mean High Water, the Marine Management Organisation (MMO). It is anticipated that the strategy will provide guidance to relevant planning authorities by setting a proposed approach for sustainable flood risk and coastal erosion risk management and adaptation within the strategy area to be implemented over the next 100 years. The relevant national planning policy and development frameworks relevant to the strategy are:

- **National Planning Policy Framework (NPPF)** (Ministry of Housing, Communities and Local Government, July 2018), which sets out the government's planning policies and how they should be applied. The NPPF identifies that planning policies and decisions should play an active role in guiding development towards sustainable solutions, but in doing so should take local circumstances into account, to reflect the character, needs and opportunities of each area. Of particular relevance to the strategy are policies relating to the historic and natural environments, climate change and flood risk. The NPPF requires Local Planning Authorities to take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures.
- **Marine Policy Statement (MPS)** (HM Government, 2011), which provides the framework for preparing marine plans and informing decisions in the marine environment while interacting with the existing terrestrial planning regime in the study area.

The relevant plans within the strategy area that implement these policies are as follows:

- The **East Lindsey Local Plan** (adopted July 2018) comprises a Core Strategy and Settlement Proposals. The adopted Local Plan replaces the 1995 (as updated) Local Plan and guides growth and development in East Lindsey up to 2031. In addition to relevant strategic policies in terms of environmental protection (e.g. landscape, biodiversity and geodiversity, green infrastructure), the Core Strategy includes a set of strategic policies regarding development in Coastal East Lindsey, which sets out (of specific relevance to the strategy):
    - Where ELDC want to be: a coast with a strong, diverse and growing economy and business sector; providing all year round tourism, with Skegness and Mablethorpe continuing to offer safe traditional family holidays and incorporating the wild, beautiful and natural landscape of the coast; a broadly stable population with access to good quality housing; and transforming flood risk into a positive part of the coast, where communities are well-informed, self-prepared and resilient and partners work together to ensure this is the case.
    - What Coastal East Lindsey will look like: a vibrant place where people want to live, invest, visit and work; a growing and diversified economy with year round tourism and accommodation and an engaged population; sufficient housing built; a flourishing Coastal Country Park with farming at its heart providing access to the coast; and flood mitigation, design and emergency planning to be integral to development.
    - Aspects of note in Strategic Policies 17 (Coastal East Lindsey), 18 (coastal housing), 19 (holiday accommodation) and 20 (visitor economy) of particular relevance are:
        - Ensure development satisfies the Sequential and Exception Test and all relevant development provides adequate flood mitigation;
        - Give high priority to development that extends and diversifies all year round employment opportunities;
        - Support improvements to existing flood defences, the creation of new flood defences and infrastructure associated with emergency planning;
        - Support development on the Skegness and Mablethorpe Foreshores, which improves the quality of and diversifies holiday facilities and attractions; but must not cause unacceptable harm to sand dune habitats;
        - Support development in Sutton on Sea, including along its foreshore, which supports the economy and lengthens the holiday season but does not detract from settlement character;
        - Support development of the Wild Coast Vision of the Coastal Country Park where it conforms to the principles of sustainable development; and
        - Not to support permanent living in caravans in the coastal area.
- **East Inshore and East Offshore Marine Plan** (Marine Management Organisation, 2014). Marine plans set out how the MPS will be implemented in the plan areas and form part of a new plan-led management system for marine activities. They aim to provide a more coherent policy context and a forward-looking, proactive and spatial planning approach to the management of the marine area, its resources, and the

activities and interactions that take place within it. The plans look forward 20 years and will be subject to periodic review during this time. A single marine plan has been prepared for the East Inshore and East Offshore Plan areas which include the strategy area. The East Inshore area includes the area of sea within the seaward limits of the territorial sea adjacent to the UK (to 12 nautical miles) between Flamborough Head and Felixstowe. The East Offshore area extends outwards from the boundary of the territorial waters to the limit of the UK's Exclusive Economic Zone and north and southwards to the boundaries with the adjacent marine planning areas. The marine plan includes: a future vision for the marine plan area (in 2034); objectives describing how that vision will be achieved; and a set of 38 policies that provide direction or guidance on how decisions should be made to ensure the plan objectives are met. Of particular relevance to the strategy are policies AGG1 to AGG3 which relate to the extraction of marine aggregates, on which the present beach nourishment operations are reliant as noted within the Marine Plan. Progress in delivering the objectives of the Marine Plan in the period 2014-2017 was reported by Defra in 2017[20].

3.4.3 Flood risk/water management plans

Key strategies and plans relevant to the management of the water environment that are directly relevant to this strategy are set out below.

- The **National Flood and Coastal Erosion Risk Management Strategy for England** (Environment Agency, 2011). The strategy sets out a national framework for managing the risk of flooding and coastal erosion. It helps risk management authorities and communities understand their different roles and responsibilities under the Flood and Water Management Act (2010). It addresses all forms of flooding and coastal erosion consistent with the definitions of the Act. The strategy aims to ensure that Defra, the Environment Agency, local authorities, water companies, internal drainage boards and other FCERM partners work together to:
    - maintain and over time improve standards of protection against flood and coastal erosion risks where it is affordable to do so;
    - increase the overall level of investment in flood and coastal erosion risk management to supplement central government expenditure;
    - help householders, businesses and communities better understand and manage any flood and coastal erosion risks that they face;
    - ensure fast and effective response to and recovery from floods when they do occur;
    - give priority to investment in actions that benefit those communities which face greatest risk and are least able to afford to help themselves;
    - encourage and support local innovation and decision making within the framework of river catchments and coastal cells; and
    - achieve environmental gains alongside economic and social gains, consistent with the principles of sustainable development.
- **Flamborough Head to Gibraltar Point Shoreline Management Plan Review (SMP2)** (HECAG, 2010). SMPs are non-statutory advisory plans produced by Coastal Steering Groups (in this case the Humber Estuary Coastal Authorities Group

[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/604900/east-marine-plans-three-year-progress-report.pdf

– HECAG) that set high level policy approaches for the future management of flood and erosion risk along the coastline. They involve undertaking a large scale assessment of the risks associated with coastal processes and present a long term (covering three epochs: 0-20, 0-50 and 0-100 years) policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner. The management policies identified for the strategy area (policy units N to P), are shown in Table 2.1.

- **The Humber Flood Risk Management Strategy (FRMS)** (Environment Agency, 2008). The Humber Flood Risk Management Strategy sets out the long term plan for managing flood risk from the Humber Estuary. The area between Cleethorpes to Saltfleet (identified by the Humber FRMS as flood areas 26 and 27) immediately adjoins the Saltfleet to Gibraltar Point strategy area. The recommendations of the strategy for this area were for the repairs of existing defences as required within the strategy period and the implementation of a managed realignment scheme at Donna Nook. This strategy is currently undergoing formal review with the appraisal process due for completion in Autumn 2020.
- **The Wash SMP2** (East Anglia Coastal Group 2010). The Wash Shoreline Management Plan covers approximately 110 km of coast from Gibraltar Point to Old Hunstanton. It determines the best ways to manage the risks of flooding and coastal erosion in a sustainable way for the next 100 years. The Wash SMP2 boundary adjoins the strategy area at the southern point of Gibraltar Point along the right hand bank of the Steeping River. The Gibraltar Point spit system acts as a morphological break between the sandy beaches within the strategy area and the mudflats of The Wash to the south. The SMP2 recommendations for the adjoining policy development zone (PDZ1) between Gibraltar Point and Wolferton Creek is to sustain the flood defence for communities and their hinterland in the low-lying areas around The Wash. This includes an increase in management as needed to sustain the current level of flood risk in the face of climate change.
- **Anglian River Basin District: Flood Risk Management Plan** (FRMP) (Environment Agency 2015). The first set of FRMPs were published in early 2016 to meet the requirements of the 2007 EU Floods Directive, implemented in England by the Flood Risk Regulations 2009. FRMPs identify the risk from flooding within defined River Basin Districts and set out objectives and measures identifying how risk management authorities will manage that risk in the period between 2015 and 2021. In so doing, they aggregate information about all sources of flooding, and coastal erosion where appropriate, to better inform prioritisation, decision making and work programming. The strategy area is located in the Anglian RBD and the Witham Catchment. The Anglian RBD FRMP includes specific measures to implement the actions recommended in the SMP2 (HECAG, 2010) and to develop and implement the Saltfleetby to Gibraltar Point strategy.
- **Anglian River Basin District: River Basin Management Plan** (RBMP) (Environment Agency, 2015). RBMPs have been prepared to protect and improve the quality of our water environment, including river, lake, groundwater, estuarine and coastal water bodies, fulfilling the requirements of the EU WFD and contributing to the objectives of other EU Directives. The 2015 RBMPs are an update of, and replace the first RBMPs published in 2009. The Anglian RBMP sets out: the current state of the water environment; pressures affecting the water environment; environmental objectives for protecting and improving the waters; programme of measures and actions needed to achieve the objectives; and progress since the 2009 plan. It also informs decisions on land-use planning.

- **East Lindsey Strategic Flood Risk Assessment** (SFRA) (East Lindsey District Council, 2017). The SFRA provides an assessment of flood risk to inform ELDC's strategy for delivering sustainable development. For coastal East Lindsey, the Environment Agency flood hazard maps are used to identify and categorise the level of danger, which is used to provide the basis for establishing a 'least risk' strategy for future development and to provide evidence for the Sequential Test as part of the decision making process for planning applications. For Inland East Lindsey, the Environment Agency Flood Zone Maps (as amended) are used as a constraint in the site allocation process for the Local Plan. Where a part of a site lies in or abuts Flood Zones 2 or 3 the capacity of the site to accommodate development has been adjusted to reflect this issue.

3.4.4 Other relevant plans

Other relevant plans or strategies that will require consideration during the development and in-combination assessment of the strategy include:

- **Greater Lincolnshire Coastal Vision:** The Greater Lincolnshire Local Enterprise Partnership (GLLEP): The emerging Coastal Vision is being developed by GLLEP and seeks to draw together a number of important strategies and plans (including this strategy) that set out significant aspirations for the future of Coastal Greater Lincolnshire, often based on extensive public and stakeholder consultations, into a coherent whole, while focusing on the GLLEP's ambitions for the coast's contribution to Greater Lincolnshire's economic growth. Greater Lincolnshire's ambitions for its coast are:
    - To sustain and grow coastal businesses and the economy.
    - To sustain and develop coastal prosperity through infrastructure.
    - To protect and sustain the coastal environment.

  Its vision is that by 2035 coastal communities and businesses will be seen as good opportunities for investment because of secure water supply and coastal management, planning policy that supports appropriate growth and the environment, and a thriving visitor economy that benefits local communities and visitors alike.

  This includes a developing **Wild Coast Vision** for the Lincolnshire coast that seeks to deliver a sustainable natural coastal environment providing high quality facilities for communities and visitors, improvements for wildlife and contributing to a healthy local economy. Its aims are to:
    - Create and sustain a diverse landscape-scale network of wildlife habitats.
    - Support and encourage a healthy local economy based on a year-round tourism destination.
    - Increase awareness and understanding of the natural and cultural heritage of the area; building recognition locally, nationally and internationally.
    - Provide recreational opportunities for local residents and visitors within the natural environment.
- The **Lincolnshire Coastal Study** was completed by the Lincolnshire Coastal Study Steering Group[21] in March 2010. This considered a number of options looking forward

[21] The Lincolnshire Coastal Study Steering Group comprised the following organisations: Lincolnshire County Council, East Lindsey District Council, Boston Borough Council, South Holland District Council, Government Office for the East Midlands, East Midlands Development Agency, Environment Agency, Natural England, East Midlands Regional Assembly and the Internal Drainage Boards.

20, 50 and 100 years identifying how sustainable communities might be developed along the Lincolnshire coast. These options were examined against a number of core principles and the flood hazard maps which formed the central evidence base of the study. The study was developed to inform the preparation of land use policies in the study area and provide a tool to evaluate proposed developments. In taking forward the principles of the study, a Coastal Pathfinder Project then considered various aspects of the implications of coastal flooding. This project, funded by Defra in 2009, was aimed at counteracting the adverse effects of coastal blight on communities, properties and businesses and helping communities to adapt to the long-term impacts of climate change.

4. Approach to the SEA

4.1 Overview

The approach to the SEA has met the requirements of the SEA Directive and transposing Regulations and has generally followed the various SEA stages set out in 'A Practical Guide to the Strategic Environmental Assessment Directive' published by the Office of the Deputy Prime Minister in 2005. The key steps have involved:

- Establishing the environmental baseline and the relationships with other plans and strategies that are relevant to the strategy, as described in Section 3 and Appendix F.
- From this, establishing and then consulting on: the proposed scope of the SEA; the proposed appraisal framework, and the proposed assessment methodology via the preparation and issue of the Scoping Consultation Document (SCD) in September 2016.
- Appraisal of the range of options considered as part of the strategy development in terms of their potential effects on the "scoped in" environmental receptors identified in Table 4.1 using the assessment criteria and methodology set out in Sections 4.3 and 4.4. This informed the identification of the preferred option and the proposed strategy.
- Identification of the potential effects of the proposed strategy (based on a set of assumptions regarding its implementation) and where significant effects are predicted, recommendation of measures to mitigate and monitor these effects. Further actions and targets are identified, where appropriate, to provide the basis for delivering the mitigation measures and monitoring the effects of the strategy in the long-term following implementation. These targets will include statutory obligations with which the strategy must comply.

This section provides details of the approach to the SEA during the scoping stage (Section 4.2); and describes the objectives and assessment criteria (Section 4.3) and assessment methodologies (Section 4.4) used during the staged multi-criteria option appraisal and the assessment of the proposed strategy. This section also describes any key assumptions, uncertainties and difficulties encountered in undertaking this assessment (Section 4.5).

The assessment of effects was informed by professional judgement and experience from other flood and coastal erosion risk management related SEAs, as well as an assessment of national, regional and local trends. Where appropriate, the assessment uses mapping data and GIS to identify areas of potential impact, for example due to the presence of environmental designations.

4.2 Scope of the SEA

The spatial scope of the SEA is the extent of the strategy area as defined in Section 2.1, extending beyond this as needed to include consideration of any additional sensitive environmental receptors, for example, physical changes in The Wash resulting from downdrift processes or the offshore sources of suitable beach nourishment material.

The temporal scope of the SEA is the 100 year time horizon of the strategy, focussing on the strategy proposals in the short, medium and long term.

Table 4.1 summarises the issues/topics that were 'scoped in' and are addressed within the SEA; with full details provided in Appendix H and summarised by topic in Section 6. These were identified from a review of the baseline information and relevant plans, policies and programmes and consideration of relevant key environmental issues, constraints and opportunities (described in Table 3.2) at the scoping stage and set out within the SCD. No

significant changes to this proposed scope or overall approach to the SEA were made following consultation on the proposed scope of the SEA undertaken in September 2016 (see Section 5 for details).

Table 4.1: Summary of topics/receptors scoped in (refer to Appendix H for full details)

Topic	Sub-topic	Receptors/opportunities scoped in
Population, health and local economy	Population and health	• Population and properties at risk – including an increasingly ageing population • Viability of communities
	Social deprivation	• Areas of social deprivation and vulnerable communities at risk
	Tourism and recreation	• Regionally important tourist facilities and attractions • Importance of amenity beach • Regionally important recreational and amenity resources • Opportunities for creation of new and diversification of attractions/resources
	Economic activity	• Existing industry, commercial and economic activities that contribute to the economy – notably agriculture, tourism and commercial fisheries/shellfisheries • Opportunities for investment and economic diversification
Material assets	Transport infrastructure	• Key transport routes at risk – roads
	Critical infrastructure	• Critical infrastructure at risk – emergency services, power/water infrastructure, windfarm landfalls
	Availability of finite resources	• Long term sustainability and available supply of required materials
Biodiversity, flora and fauna	International/ national nature conservation sites	• Proposed or formally designated European sites (SPA, SAC), Ramsar sites, MCZs, SSSIs, NNRs
	Local nature conservation sites	• Locally important sites – i.e. LNR, LWS or SINCs
	Coastal/terrestrial ecology	• Habitats of Principal Importance within coastal or terrestrial areas affected • Specific legally protected species/those of conservation concern along the coastal frontage • Opportunities for habitat creation/improvements
	Marine/intertidal/ subtidal ecology and fish	• Benthic and epibenthic invertebrates of conservation concern • Fish and shellfish, including nursery/spawning grounds, of local importance • Opportunities for habitat improvements
Soils, geology and geomorphology / sediment	Designated earth heritage sites	• Designated sites – geological SSSI, RIGS, LGS
	Geomorphology and sediment	• Geomorphology and sediment system within the strategy area and downdrift into The Wash
	Contaminated land	• Areas of known contaminated land or licensed landfill sites at risk
Land use and management	Land use	• Principal land uses at risk – agricultural land

Topic	Sub-topic	Receptors/opportunities scoped in
Water and hydromorpho-logy	Surface water and groundwater quality	• WFD waterbodies – coastal, river and groundwater – and associated Protected Areas
Air and climatic factors	Climate	• Contribution to, vulnerability and adaptability to climate change
Historic environment	Contribution to heritage and landscape	• Coastal heritage of seaside towns, historic townscape/seascape – heritage assets and their contribution to wellbeing, education, sense of place and heritage tourism
	Designated heritage assets	• Designated heritage assets (scheduled monuments, registered parks and gardens, protected wreck sites, listed buildings, conservation areas)
	Non-designated heritage assets	• Significant known non-designated assets or clusters of assets and their setting, based on the Lincolnshire HER
Landscape and visual amenity	Landscape/ seascape character	• Landscape, seascape and historic character – in particular along the coastal frontage
	Visual amenity	• Significant changes in views along the coastal frontage
All receptors	Inter-relationships and cumulative effects	• Inter-relationships between receptors where relevant i.e. secondary, synergistic or cumulative effects

The scoping process also identified, in consultation with statutory consultees, a number of issues/topics that were scoped out from further consideration within the SEA beyond the scoping stage (refer to Appendix H for details of the rationale for their exclusion). These will be considered further at the project-level environmental assessment stage during the future implementation of the proposed strategy. These 'scoped out' issues/topics comprise:

- Population and human health: impacts on noise levels.
- Biodiversity, flora and fauna: impacts on individual legally protected species outside designated site boundaries, but within the wider study area; impacts on other fish or shellfish within the coastal waters.
- Soil, geology and geomorphology: impacts on soils and geology.
- Air quality: impacts on air quality.
- Historic environment: non-designated heritage assets within the strategy area that are unlikely to be directly affected by the strategy.
- Landscape and visual amenity: detailed consideration of changes in visual amenity.

The SEA does not fully address temporary impacts likely to result from the construction of the proposals recommended within the strategy (e.g. from the raising of sea defences); although strategic issues relating to, for example the timing of works, have been considered where relevant to this assessment. Specific construction-related issues are more appropriately considered during any project level Environmental Impact Assessment (EIA) or non-statutory environmental assessments that will be required for specific scheme(s) that will arise from the implementation of the proposed strategy.

4.3 SEA objectives and assessment criteria

The environmental baseline review described in Section 3 and Appendix F and the scoping of relevant issue/topics described in Section 4.2 informed the identification of a set of SEA objectives and associated assessment criteria at the scoping stage. These were developed to be used to assess the environmental effects of strategic options and the proposed strategy. The assessment criteria are posed as questions to guide option assessment and to help describe the effects of the strategy and focus on the key issues that would have a significant influence on the development of the strategy.

The development of SEA objectives for the strategy was an iterative process. An initial set of objectives was identified and set out in the SCD issued in September 2016. These were reviewed in the light of comments received and further understanding of the key environmental problems, issues and opportunities concerning the coastal frontage as the SEA process progressed. No substantive changes have been made to those identified in the SCD, with only minor edits/text changes required.

The SEA objectives and assessment criteria used to assess the proposed strategic options and the proposed strategy are listed in Table 4.2.

4.4 Assessment methodology

A description of the approach taken during the appraisal of options is provided in Section 2.5. This process utilised, as appropriate at each stage of the appraisal, the assessment criteria and methodology described in this section and in Appendix C.

The proposals set out in the draft strategy were assessed in terms of their potential for significant effects on the environmental receptors/topics scoped into the assessment using the SEA objectives and associated assessment criteria (i.e. the appraisal framework) described in Section 4.3. The potential effects are described in terms of their nature, permanence, spatial scale and duration using the criteria defined in Table 4.3, with their significance concluded in terms of the criteria provided in Table 4.4.

The SEA has been an expert, judgement-based assessment, supported by appropriate evidence and experience from other coastal flood risk management related SEAs, as well as an assessment of national, regional and local trends. Where appropriate, the assessment has utilised mapping data and GIS to identify areas of potential impact, for example due to flood risk or presence of environmental designations.

For the assessment of options and the proposed strategy, achievement of objectives was considered in terms of the present day conditions, taking into account and comparing with predicted changes in the absence of the strategy over its 100 year duration, i.e. the do nothing baseline option, where appropriate. This means that, for example, proposals to sustain the existing defence line and level of flood protection would have a positive effect on receptors such as residential properties in terms of relevant SEA objectives by avoiding the adverse effects that would result from the do nothing baseline option. It is assumed that these effects could begin to occur in the short term, although in reality there would be no change from the current situation until conditions change over time.

Table 4.2: Proposed SEA objectives and assessment criteria

Topic/Receptor	SEA objective	Sub-objectives	Assessment criteria
Population, health and local economy	**1. Manage risk to the health of people and local communities**	1.1. Minimise the vulnerability of people and public health to tidal flooding 1.2. Avoid risk to life through an adaptive approach	• *Do the proposals change the number of residential properties at risk from flooding from the present day?* • *Do the proposals seek to manage future risks to properties through an adaptive approach?* • *Do the proposals change social vulnerability and deprivation in affected areas from the present day?* • *Do the proposals affect the viability of local communities?*
	2. Avoid damage to, and enhance where possible, recreation and tourism	2.1. Avoid damage to and loss of use of significant visitor attractions and recreational resources 2.2. Support opportunities to attract investment in coastal tourism and improve visitor attractions and recreational resources	• *Do the proposals help to maintain or improve amenity beaches and associated facilities, compared to the present day?* • *Do the proposals maintain or improve visitor attractions from the present day?* • *Do the proposals maintain, or improve, existing access and recreational provisions/facilities along the coast, compared to the present day?* • *Do the proposals contribute to future regeneration of the tourism industry or improve formal or informal recreational facilities/opportunities?*
	3. Minimise risk to economic activities and facilitate the creation of economic opportunities	3.1. Minimise the vulnerability of areas of significant employment/economic activity to tidal flooding 3.2. Ensure compatibility with planned development and regeneration 3.3. Support and facilitate the creation of economic opportunities 3.4. Avoid damage to commercial fishing activity and shellfisheries	• *Do the proposals change the level of risk to areas of significant employment or economic activity?* • *Could the proposals generate future employment/development opportunities?* • *Are there conflicts between the proposals and ongoing/planned development?* • *Do the proposals affect commercial fishing/shellfisheries activity (e.g. by affecting important fisheries, restricting access to fishing grounds or presenting risks to water quality) in The Wash and offshore waters?*

Topic/Receptor	SEA objective	Sub-objectives	Assessment criteria
Material assets	**4. Minimise risk to infrastructure**	4.1. Minimise the vulnerability of transport infrastructure to tidal flooding 4.2. Avoid damage to, or loss of, critical services/infrastructure	• *Could the proposals conflict with or change the risk of flooding to key transport routes (roads) from the present day?* • *Could the proposals conflict with or change the risk of flooding to critical services/infrastructure from the present day?*
	5. Use resources sustainably	5.1. Minimise the consumption of finite materials	• *Do the proposals require the use of significant volumes of finite materials? Are these readily available?* • *Do the proposals require the sourcing of and regular input of finite materials over the lifetime of the strategy?* • *Are there any constraints on the availability of materials required? Do the proposals allow flexibility for the sourcing of alternatives?*
Biodiversity, flora and fauna	**6. Maintain, and where possible, enhance flora and fauna**	6.1. Avoid damage to/loss of, and, where possible enhance, internationally and nationally designated sites of nature conservation interest 6.2. Avoid damage to/loss of, and where possible enhance, locally designated sites of nature conservation interest 6.3. Avoid damage to/loss of coastal and marine habitats and dependent species of conservation concern, where known to be present 6.4. Avoid disturbance and damage to fish/shellfish and their spawning/nursery grounds 6.5. Support opportunities to enhance biodiversity through habitat restoration or creation within the strategy area	• *Do the proposals affect conservation/condition status of international or national nature conservation sites (SPA, SAC, Ramsar sites, MCZ, SSSI, NNR), or support achievement of conservation objectives, compared to the present day?* • *Do the proposals affect the condition of local nature conservation sites (LNR, LWS, SNCI) compared to the present day?* • *Could the proposals damage or result in loss of Habitats of Principal Importance present within the strategy area?* • *Could the proposals affect Species of Principal Importance or known species of conservation concern, known to be present along the coastal frontage or in the coastal waters within the strategy area?* • *Could the proposals affect fish/shellfish or their spawning/nursery grounds within the strategy area?* • *Are there any opportunities for habitat restoration or creation?*

Topic/Receptor	SEA objective	Sub-objectives	Assessment criteria
Soils, geology and geomorphology	**7. Protect geological diversity and work with natural geomorphological processes**	7.1. Avoid damage to/loss of, and where possible enhance, nationally and locally designated sites of earth heritage interest 7.2. Work with natural geomorphological processes, wherever possible, including sediment movement	• *Do the proposals affect geological interests of nationally (SSSI) or locally (LGS, RIGSs) designated earth heritage sites, compared to the present day?* • *Do the proposals work with natural geomorphological processes, including sediment movement, and enable natural evolution of the coastline?*
	8. Minimise risk to sites with pollution potential	8.1. Minimise the vulnerability of areas of known/potential contaminated land and landfills to tidal flooding	• *Do the proposals change the risk of flooding to known and potentially contaminated land and licensed/historic landfills, compared to the present day?*
Land use	**9. Support varied land uses along the coastline**	9.1. Manage risk to agricultural land, in particular that of highest quality, from tidal flooding 9.2. Manage risk to other key land uses from tidal flooding	• *Will the proposals change risk of tidal flooding to the existing agricultural land, compared to the present day, affecting its quality and versatility?* • *Do the proposals impact on other key land uses?*
Water and hydromorphology	**10. Maintain, and where possible improve, the quality of water resources as defined by the WFD**	10.1. Protect the quality of surface waters and groundwater and support the delivery of WFD objectives and requirements for classified water bodies and Protected Areas	• *Will the proposals help or conflict with meeting WFD objectives for good ecological status/potential for water bodies (coastal, river and groundwater) within the strategy area?* • *Will the proposals affect or contribute to the delivery of morphological mitigation measures for water bodies (coastal, transitional, river and groundwater) within the strategy area?* • *Will the proposals affect WFD protected areas, e.g. Bathing Water Directive, for water bodies within the strategy area?*
Climate	**11. Minimise contribution, reduce vulnerability and enable adaptation to**	11.1. Minimise contributions to future climate change 11.2. Reduce vulnerability to future climate change	• *Will the proposals contribute to climate change?* • *How vulnerable are the proposals to climate change?* • *Can the proposals adapt to future climate changes?*

Topic/Receptor	SEA objective	Sub-objectives	Assessment criteria
	future climate change	11.3. Enable adaptation to future climate change	
Historic Environment	**12. Conserve, and where possible enhance, the historic environment, heritage assets and their settings**	12.1. Conserve the key characteristics of the historic landscape/townscape along the coastal frontage, in urban areas and at the seaside resorts 12.2. Manage harm to, and where possible, enhance designed heritage assets 12.3. Manage harm to locally listed and known undesignated archaeological and palaeo-environmental assets along the coastal frontage, where relevant to the assessment as agreed with LCC Historic Environment Officer 12.4. Support the contribution of the historic environment to the local tourism economy, sense of place and community well being	• *Are the proposals sympathetic to the local character of the historic environment, including the characteristics of the historic landscape or areas of townscape value (e.g. Conservation Areas) and seaside resort heritage?* • *Will the proposals affect the contribution of the historic environment to the tourism economy, sense of place and community wellbeing within the strategy area?* • *Will the proposals change the risk of flooding to nationally designated heritage assets (Scheduled Monuments, Registered Park and Gardens, Protected Wreck sites, listed buildings) and locally designated heritage assets (listed buildings, Conservation Areas) within the strategy area; or directly affect their physical structure/condition or setting?* • *Will the proposals affect known significant locally listed or undesignated archaeological and palaeo-environmental features along the coastal frontage within the strategy area, where identified as potentially sensitive in consultation with Lincolnshire County Council Historic Environment Officer?* • *Will the proposals encroach on undeveloped land, which may present a risk of encountering archaeological remains?* • *Where known, is there any potential for loss of access to heritage resources?* • *Could the proposals include/promote opportunities for heritage-led regeneration or heritage-based tourism, including traditional seaside tourism?*
Landscape and visual amenity	**13. Maintain and enhance the quality and character of the**	13.1. Manage risk to landscape character from tidal flooding 13.2. Protect landscape and seascape character from adverse changes	• *Will the proposals lead to the introduction of features which are unsympathetic to the present character of the landscape/seascape and cause deterioration?*

Topic/Receptor	SEA objective	Sub-objectives	Assessment criteria
	landscape and seascape	13.3. Maximise opportunities to enhance landscape and seascape character and value 13.4. Protect significant sea views where these contribute to the quality of the landscape	• *Will the proposals improve the value of the existing landscape/seascape (i.e. the aesthetic satisfaction derived from a landscape type), compared to the present day?* • *Will the proposals result in an adverse change to sea views along the coastal frontage where these significantly contribute to the value and quality of the coastal landscape?*

Table 4.3: Aspects used to consider and describe the identified effects of the proposed strategy and options.

Aspect	Descriptors used
Nature	• **Positive** (**+**) • **Neutral** (**N**) • **Negative** (**X**) • **Uncertain** (**?**)
Permanence and reversibility	• A **permanent** effect (**Perm**) results from a physical change that is anticipated to last beyond the life of the strategy. • A **temporary** effect (**Temp**) results from an operational change that could be addressed if there is a change of policy, or is a short term condition, that could be anticipated to reverse in the future. • A **reversible** effect (**Rev**) is an environmental effect that can be reversed, for example an incident of water pollution can be cleaned up over time. • An **irreversible** effect (**IRev**) 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** (**Local**)**:** effect is restricted to the immediate location of the proposed action or to a specific site or settlement within the strategy area. • **Regional** (**Reg**): effect is anticipated to cover a significant proportion of Lincolnshire and surrounding areas. • **National** (**Nat**): effect covers the whole of England and/or the UK (or international).
Duration	• **Short term** (**ST**): effects expected within 5 years of implementation. • **Medium term** (**MT**): effects expected within 10 years of implementation. • **Long term** (**LT**): effects expected beyond 10 years following implementation within the strategy timeframe.

Table 4.4: Criteria used to determine the significance of the identified effects the proposed strategy and options in terms of the SEA objectives.

++ **Major Positive**	The proposal would be significantly beneficial to the SEA objective by resolving an existing environmental issue and/ or maximising opportunities for environmental enhancement. This would be considered to be a significant effect.
+ **Minor Positive**	The proposal would be partially beneficial to the SEA objective by contributing to resolving an existing environmental issue and/or offering opportunity for some environmental enhancement. This effect would not be considered to be of significance.
N **Neutral**	The proposal would have a neutral effect on the SEA objective, i.e. no change from present day.
? **Uncertain**	There is insufficient detail available on the proposal or the baseline situation in order to assess how significantly the SEA objective would be affected by the proposal.
X **Minor Negative**	The proposal would partly undermine the SEA objective by contributing to an environmental problem and/or partially undermine opportunities for environmental enhancement. This effect would not be considered to be of significance.
XX **Major Negative**	The proposal would severely undermine the SEA objective by contributing to an environmental problem and/ or undermining opportunities for environmental enhancement. This would be considered to be a significant effect.

4.5 Assumptions, gaps and uncertainties

Key considerations that influenced the assessment and should be taken into account in the interpretation of these results are set out below:

- The environmental baseline review, scoping assessment and options appraisal undertaken at the outset of the strategy development and reported in Appendices C, E, F and G largely reflect the conditions at the time of preparation of these documents in 2016/17, although key aspects have been updated for this assessment within this report.
- Numerous assessments and studies have been undertaken and survey/monitoring data collected for the strategy area prior to and since the start of the Lincshore beach nourishment strategy/scheme and the associated monitoring programme in 1994. In developing the approach to this SEA it has been essential to streamline the available information for the strategy area to define an appropriate baseline that reflects present (and future predicted conditions) for the strategy area, whilst providing a level of detail that enables an effective strategic-level assessment.
- Data used in the preparation of this SEA is primarily the compilation of secondary information derived from a variety of sources. It is assumed that this data is accurate.
- For the assessment of options and the proposed strategy, achievement of objectives was considered in terms of the present day conditions, taking into account and comparing with predicted changes in the absence of the strategy over its 100 year duration, i.e. the do nothing baseline option, where appropriate. This means that, for example, proposals to sustain the existing defence line and level of flood protection would have a positive effect on receptors such as residential properties in terms of relevant SEA objectives by avoiding the adverse effects that would result from the do nothing baseline option. It is assumed that these effects could begin to occur in the short term, although in reality there would be no change from the current situation until conditions change over time.
- Although the proposed strategy identifies a preferred approach, there is inherent uncertainty regarding the timing and type of actions that will be taken to implement the strategy which will largely be dependent upon the availability of funding, future climate change and other triggers. To address this, this assessment of the strategy proposals considers two reasonable scenarios, i.e. (1) continuing with the present management or (2) introducing rock control structures, to present a reasonable 'worst case' 'do something' position whatever the future outcome.
- The preferred strategic approach described in Section 2.6 sets out proposals at a strategic level. Therefore, to provide further detail for the SEA, this assessment is based on a set of design assumptions provided in Appendix D. These design assumptions provide details of the potential location, form and structure of the proposals to implement both scenarios in the medium and long term: continuing beach nourishment or introducing rock control structures. In addition, as the form of the rock control structures are yet to be determined, consideration of the potential impacts of both rock groynes and fishtail structures have been included to represent a reasonable worst case position.
- Given the UK's imminent exit from the EU, it is assumed that there will no changes to the present legal requirements in the short term; with some uncertainty in the medium to long term. The EU 'Environmental acquis' will be fully transposed into UK law to ensure continued environmental protection throughout the process of the UK exiting the EU, whilst a legal framework is put in place to enact the requirements of the

Environmental Principles and Governance Bill. This will include the creation of an independent statutory environmental watchdog, working alongside a new policy statement which will set out the environmental principles to be used to guide and shape UK legislation. Any changes to UK environmental law that affect the issues raised/addressed with the SEA ER would act as a trigger for the future review of the strategy.

- There is a reasonable level of certainty associated with the assessment of the effects in the short term and to a degree, into the medium term (for scenario 1 – continuing present management). However, the effects of the strategy in the medium to long term are inevitably less certain and more difficult to predict given possible future changes in environmental conditions and the unknown effects of introducing new structures along the coast, and where these may be located/how many are required (behind the assumtions made for this assessment set out in Appendix D). Therefore, where appropriate, the focus of this strategic assessment is to identify the key sensitive receptors and set out appropriate mitigation measures to guide future actions during the future development and implementation of this strategy that will minimise adverse effects.
- Consideration of effects on species of conservation concern potentially affected by the proposed strategy, but outside the designated nature conservation sites, will be limited to those species for which adequate survey data exists regarding their distribution. The consultation on the SCD presented an opportunity for such species to be identified and their inclusion justified, where sufficient data exists – and additional data was provided by LWT to inform this assessment.
- Our understanding of the contemporary physical processes and controls that affect this coastline within the strategy area is informed by the suite of studies, modelling and analyses previously undertaken as part of the development of the overarching SMP and previous iterations of this strategy. A review of the key information from these sources pertinent to this assessment and a comprehensive analysis of beach behaviour in response to the prevailing conditions and controls (using beach profile data, historical maps and aerial photography) has been undertaken to inform the development of the strategy as set out in a Shoreline Behaviour Technical Note (CH2M, 2018). This study considered how the coast looked and behaved prior to the nourishment scheme and how the beaches have responded and changed following nourishment. Its findings have informed the development of the proposed strategy; but significant further assessment will be required to inform the future implementation of the strategy.
- Where insufficient data exists to enable the assessment of effects at a strategic level, this uncertainty has been highlighted and recommendations made within the SEA to ensure that full consideration is made during the project-specific environmental assessments required prior to the implementation of the strategy recommendations.

5. Stakeholder engagement

5.1 Introduction and approach

Effective and inclusive engagement and communications with stakeholders and the public is essential to the development of a successful strategy. The objectives of strategic engagement and communications in relation to the strategy are:

- To ensure all engagement is carried out in line with the project objectives set out by the project team.
- To build and maintain a good working relationship with all partners, encouraging them to protect and enhance the reputation of both the strategy and the Environment Agency.
- To ensure all those who are interested or affected by the development of our strategy are well-informed and aware of the strategy, that we are working with partners, key stakeholders and how to get involved.
- By working with other teams and partners, those living in the strategy area will understand the flood risk on the east coast and are supportive of the need to find a sustainable approach to flood risk management.
- By consulting with the public and stakeholders, they feel that feedback on local concerns, issues and priorities has been considered, and they are aware of what they can and cannot influence, and why.
- To maintain and enhance, where possible, the east coast's reputation as a thriving centre of tourism by finding the most appropriate way of managing flood risk.
- To ensure all Environment Agency staff are well informed about the scheme and can act as advocates during external engagement.
- To ensure the Environment Agency's reputation is protected and enhanced.
- To provide accurate and timely information to media about the strategy and interim works.
- To use agreed positive key messages for all media coverage, focusing on the benefits of the project.

A 'live' Stakeholder Engagement Plan prepared for the strategy sets out how these objectives will be achieved throughout its development. This also sets out a programme of engagement and communications actions/activities with stakeholders and the public as the strategy progresses, and the specific objectives/desired outcomes of these activities.

Building on existing relationships established in the past two decades of the Lincshore scheme, a stakeholder analysis was undertaken at the outset of the strategy review to identify the individuals or groups that are likely to affect or be affected by the proposed strategy, and determine how their interests should be addressed in the engagement activities. This analysis identified the list of stakeholders (in Appendix I) comprising statutory bodies, organisations, businesses and individuals with an interest in the strategy area, and identified an appropriate level of engagement of communication for each (monitor/inform/consult/involve – see Appendix I).

5.2 Stakeholder engagement undertaken to date

5.2.1 Actions and channels

Led by a dedicated Engagement Officer, key external communication channels used and engagement activities undertaken throughout the development of the strategy have included:

- Proactive two-way external communications via a webpage https://consult.environment-agency.gov.uk/flood-and-coastal-risk-management/sgp, press releases, newsletters and social media.
- Meetings, as required, with stakeholders throughout the strategy development.
- A series of workshops with key stakeholders at two key stages of the strategy development to inform the way forward:
    - November 2016: to discuss the need for the strategy and range of potential risk management approaches to inform the identification and appraisal of the long list of options;
    - Summer 2017: to present and consult on a short list of six leading options identified based on technical appraisals (refer to Table 5.1 for details) and feedback from the initial stakeholder workshops.
- Formal public consultation (including an e-consultation and six drop-in-sessions around the strategy area) on the short list of six leading options in February-March 2018. Drop in events were held in Saltfleet, Sutton-on-Sea, Anderby, Chapel St Leonards, Skegness and Gibraltar Point.

Figures 5.1 to 5.3 present a visual summary of the key feedback received from the stakeholder events and the public drop-in sessions. At each event, specific questions were asked of attendees on each of the approaches or options presented. For example, at the summer 2017 workshops, stakeholders were asked to rank the options presented in order of preference and to agree or disagree (ranging from strongly to neutral) whether an option:

- Is sustainable and technically feasible?
- Manages risk to the health of people and local communities?
- Maintains and enhances the quality and character of the landscape?
- Avoids damage to, and enhances where possible, recreation and tourism?

Details of the formal public consultation activities and events undertaken and the feedback received are presented in Appendix J. At each stage of this process, the feedback received from stakeholders and the general public has had a strong influence, in combination with technical appraisals, on the development of the strategy and the selection of leading options and preferred scenarios.

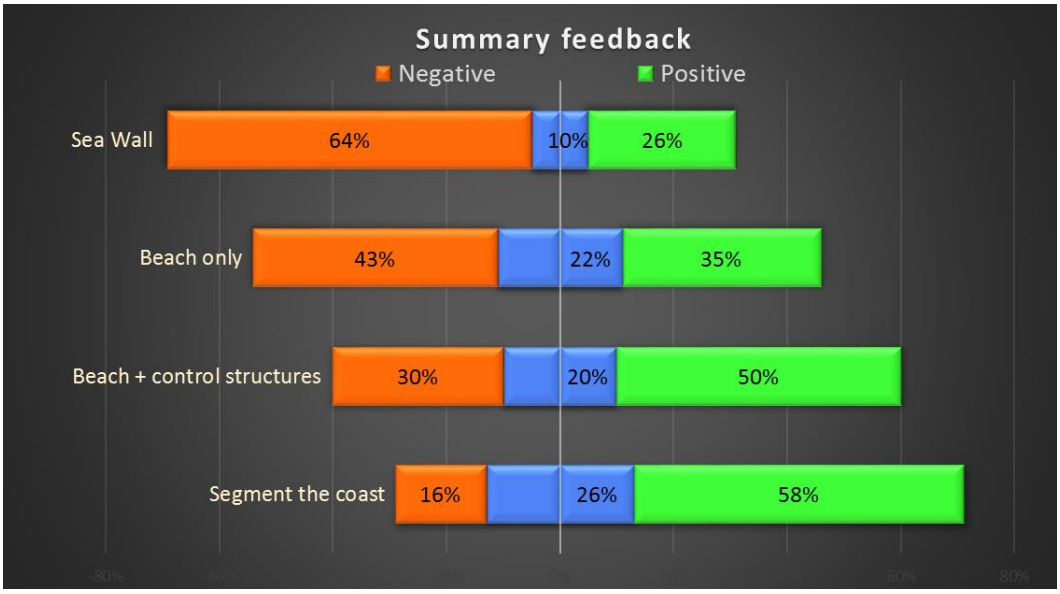


Figure 5.1: Summary feedback from the November 2016 stakeholder workshops regarding potential approaches.

Table 5.1: Short-listed leading options consulted on in 2017/2018.

Option number on Figures 5.1 and 5.2	**Option description** [Option reference in Chapter 7]
1	Sustain - Annual nourishment (with present management), increasing volumes to maintain same standard of protection. [3.2]
2	Sustain - Beach without control structures with different beach material grading. [3.7]
3	Sustain - Beach with rock armour groyne structures maintaining same standard of protection. [3.11]
4	Sustain - Beach with rock armour structure combinations maintaining same standard of protection. [3.13]
5	Sustain - Beach with rock armour structures at lower or higher standards of protection by changing nourishment volumes. [3.14]
6	Sustain - Beach with rock armour structures at lower or higher standards of protection by changing nourishment frequency. [3.15]

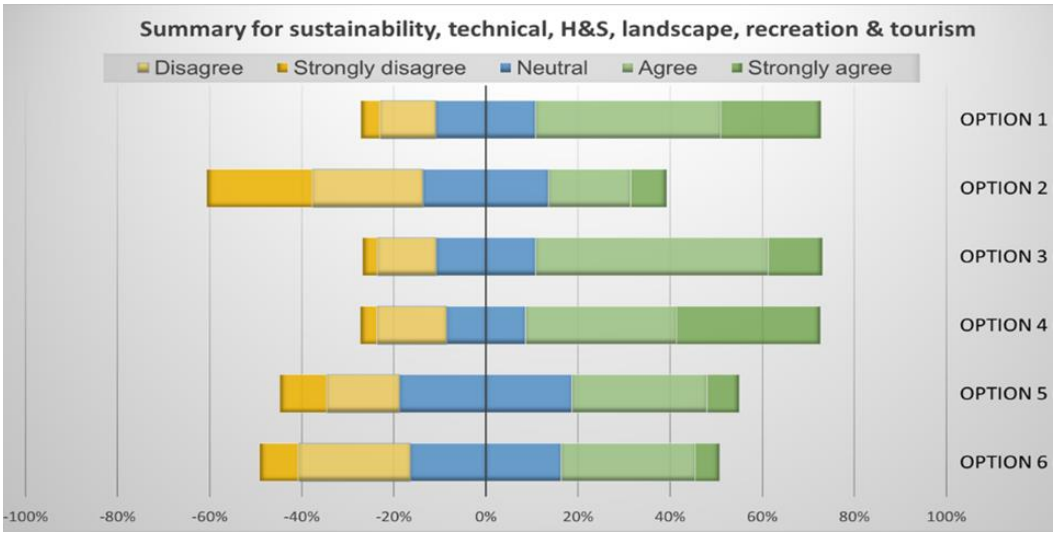


Figure 5.2: Summary feedback from the summer 2017 stakeholder events regarding the six leading options.

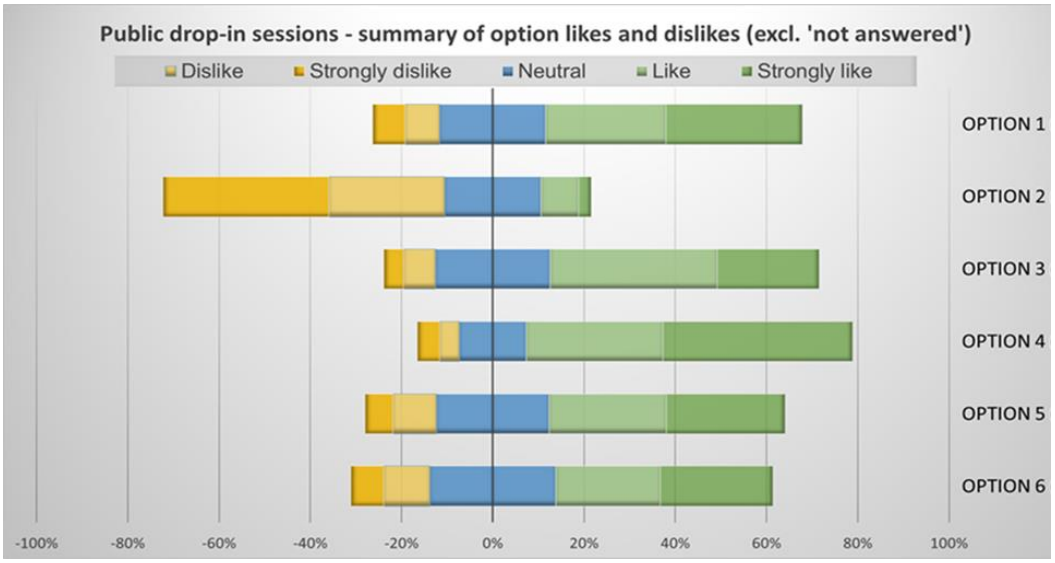


Figure 5.3: Summary feedback from the February-March 2018 public drop-in sessions regarding the six leading options.

5.3 SEA-specific consultation

In addition to the wider stakeholder and public engagement activities to inform the development of the strategy, specific consultation has also been undertaken to meet the requirements of the SEA Regulations and help shape the scope and content of the SEA.

At the outset of the strategy, the following environmental stakeholders were engaged to inform its early development:

- A key stakeholder meeting (April 2013) attended by the Environment Agency, Natural England and our key partners to discuss potential strategic options for the coastline.

- Meeting with Lincolnshire Wildlife Trust (15th October 2013) to discuss beach nourishment operations and the effects of geomorphological changes on qualifying bird populations at Gibraltar Point.
- Meetings with Natural England (22nd October 2013 and September 2014) to discuss and understand the environmental acceptability of alternative options for managing the coast.

During the scoping process, a meeting was held with key environmental stakeholders on 14th July 2016 to provide an update on the developing strategy and discuss the proposed scope of the SEA ahead of the formal issue of the SCD. This was attended by representatives from ELDC, LCC, Natural England, Historic England, Eastern IFCA and Lincolnshire Wildlife Trust (LWT) and the feedback received at this meeting was incorporated within the SCD. Discussion points raised included:

- The artificial nature of the shoreline in the context of the existing defences.
- The implications of potential future changes to the current funding rules.
- Consideration of the value of the natural environment within the appraisal in terms of its natural capital and inclusion of the intangible economic damages to/benefits of nature conservation within the strategy appraisal.
- Inclusion of the value of tourism to the economy of the strategy area within the strategy appraisal.
- Requirement to include measures to conserve biodiversity within the strategy.
- The information sources used to assess sediment transport and coastal processes and whether additional information would be sought.
- Potential movement of sediment material between the Humber estuary and the strategy area.
- Consideration of the impacts on the source location of the nourishment material required within the SEA.
- Need to agree the criteria for the inclusion of non-designated heritage assets within the scope of the SEA.
- Details of the proposed scope of the current environmental monitoring programme requested.
- Consideration of the function of the soft defences within the strategy proposals.
- Review of the boundary of the strategy area and the relationships with the adjoining strategies.

The SCD was then issued to the SEA consultation bodies (the Environment Agency, Natural England and Historic England) and other key stakeholders – LWT, ELDC, LCC, Eastern IFCA and the MMO; full details of the responses received and the arising actions/responses provided are included in Appendix J. A summary of the key points raised and actions taken are summarised in Table 5.2.

Table 5.2: Summary of scoping feedback received and actions taken.

Feedback received	Action taken
Historic England	
- Approach 5 offers best opportunity to tailor management proposals to individual areas, ensuring site/heritage asset specific impact assessments.	- Views on approaches/options have informed the appraisal of the long list of options.
- SEA should recognise palaeoenvironmental value of peat exposures, include impacts on designated and non-designated heritage assets & consider archaeological implications of all flood risk management options (including types of impact) and prioritise assessment of assets on their sensitivity and risk.	- Palaeoenvironmental value of peat exposures, and designated and non-designated assets, are included within the SEA and strategy.
- Wish to see a close association between landscape/visual amenity and heritage. - Welcome a broad understanding of historic environment impacts - social, landscape and heritage assets and their significance, and consideration of opportunities.	- Consideration of related impacts across topics has been undertaken and has informed the SEA.
- Need to justify loss/damage of significance. - Consider whether inability to assess any historic environment effects would render the SEA unfit for purpose.	- Any risks, gaps and uncertainties have been identified and actions recommended. - The SEA identifies all potentially adverse effects and required actions to avoid or mitigate effects. - The SEA is not able to fully address risks relating to unknown archaeology and no detailed desk study or site based investigation can be incorporated, in accordance with SEA good practice. - The assumptions made and resulting limitations are clearly set out so that the assessment results can be considered in this context. The information within the SEA represents the best available data and accords with relevant guidance and good practice; and consistent with coastal strategies elsewhere in England.
- Assign significance to designated assets to reflect the assessment criteria, be easily understood and take account of the referenced Planning Notes and heritage publications.	- The SEA has considered the suggested information sources.
- Consider the sensitivity of individual assets and groups during assessment, and their capacity to absorb change.	- The SEA considers the sensitivity (to flooding) and value of the heritage assets and the associated level of flood risk/impact resulting from options and the strategy.
- Consider potential temporary effects of the proposed management approaches upon perceptions, understanding and appreciation of heritage assets affected, e.g. construction programmes involving increased traffic and noise.	- Specific details of proposed construction methods are not available. The assessment has taken into account the frequency, duration and permanence of the actions required to implement the proposed strategy/preferred options.
- Keen to work collaboratively with other agencies, such as Natural England, to identify opportunities	- Engagement undertaken with Historic England and other stakeholders during the development of the strategy. This will continue during implementation – including the identification of potential opportunities.

Feedback received	Action taken
Eastern Inshore Fisheries and Conservation Authority	
- The strategy area is logical but lack of clarity on seaward extent.	- The seaward boundary of strategy area is 5 km offshore. Have assessed offshore (as well as coastal impacts) e.g. locations of potential sources of offshore nourishment material.
- Request that potting (for crab, lobster and whelk) is included within summary of existing fisheries.	- The presence/value of potting (for crab, lobster and whelk) has been included within the fisheries baseline.
- Queries if impact on bivalve seafish and/or larger crustacea should be assessed.	- Impact on bivalve seafish and larger crustacea has been assessed.
- Can measureable targets be used to measure any disturbance and damage to fish/shellfish and their spawning/nursery grounds.	- Measurable targets have not been identified within the SEA but will be incorporated within the proposed monitoring and management proposals that will inform strategy delivery.
- Consider the Lincolnshire Biodiversity Action Plan and provides other useful references.	- Information from the Lincolnshire Biodiversity Action Plan has informed the baseline conditions. - The suggested reference documents have been considered.
- Consideration of benefits is required; examples provided.	- The identified benefits have been considered as part of the SEA.
- Query why whelk, lobster and crab have been scoped out of SEA.	- Consideration of additional fisheries species i.e. whelk, lobster and crab has been undertaken.
- Proposed objectives and assessment criteria should include all types of fisheries. Nature conservation/enhancement should be considered.	- Objectives and assessment criteria applied consider all types of fisheries for which data is available to enable the assessment. Impacts on fisheries in terms of nature conservation/enhancement is considered under Objective 6.
Lincolnshire County Council – Archaeology	
- The assessment should provide sufficient evidence to understand impacts on the significance of heritage assets and their settings.	- Consideration of impacts on known heritage has been undertaken.
- The NPPF states that 'Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation' (para 128). - The SEA should contain as appropriate an archaeological evaluation report, considering the need for intrusive evaluation to inform the heritage impact statement.	- Consider that a desk-based assessment and field evaluation would be more appropriate at the next stage of strategy implementation (post SEA) when details of the proposed locations and preferred option(s) are developed.
- Would expect a report on impacts on the historic landscape.	- Consideration of potential effects on the historic landscape in terms of the landscape characterisation undertaken by ELDC has been undertaken as part of the SEA.
- Potential impacts on the settings and significance of heritage assets which would experience visual change should be evidenced.	- Consideration of impacts on setting has been undertaken as part of the SEA at a strategic level to identify any potentially significant changes and recommend appropriate mitigation. Detailed assessment of changes in views at specific receptors is not appropriate or

Feedback received	Action taken
	possible given the level of information regarding the proposed preferred option(s).
Lincolnshire Wildlife Trust	
- Recommend extending strategy area boundary north and south.	- The northern and southern limits of the strategy area align with strategy areas for the Humber and The Wash. The inland boundary is the limit of the flood hazard zone. The boundary has been extended to ensure that all potential effects have been fully considered.
- Recommend updated data for LWS and habitats of principle importance are obtained from the Greater Lincolnshire Nature Partnership.	- Updated LWS data has been utilised.
- Reference various documents/plans that should be considered as part of the SEA.	- Have considered the relevant requirements of the plans/proposals.
- Setting back floodbanks on watercourses discharging along the coast should be considered.	- Setting back the floodbanks of discharging watercourses has not been considered as flooding from the sea is the major flood risk. Even with surge tides there are cycles of low water when outfalls can discharge.
- Would expect the strategy to result in a net gain for biodiversity.	- Opportunities have been considered.
- Under Proposed SEA Objective 2, would like a clear reference to Nature Tourism.	- More explicit reference to nature conservation related tourism included.
- Recommend that the third sub-objective is amended. Enhancements should be assessed as part of all of the assessment criteria.	- Potential for enhancements considered throughout the assessment and development of the strategy.
- Strongly recommend consideration of data relating to grazing marsh and its use by wetland birds.	- Have considered coastal grazing marsh data, where the data benefits the assessment.
- Need to include impact of strategy implementation outside the strategy boundary particularly in relation to import of sand.	- The SEA considers dredging from offshore. sandbanks to implement present nourishment options. Whilst the study area has been defined around the zone of potential impacts, have allowed for broader consideration beyond this area i.e. where other offshore/downdrift impacts from the strategy may occur.
Lincolnshire County Council – Flood Risk	
- Recommend prioritisation and amendment of the proposed SEA objectives to include agriculture/food production and economic challenges in the area.	- The objectives cover the topics/issues required under the SEA Directive, adapted to reflect strategy requirements. The objectives/criteria used in the SEA form one part of a multi-criteria decision-making process that takes into account and appropriately weights economic (costs/benefits) and social (e.g. numbers of properties for which flood risk is reduced) factors. This has been used to determine the proposed strategy. This process allows weighting of the criteria to reflect local conditions/priorities. These criteria include consideration of high grade agricultural land.
Lincolnshire County Council – Biodiversity	
- Potential improved environmental outcomes are supported, and consideration should be given to linking existing sites where possible. Continued engagement welcomed.	- Consideration has been given to the aims, objectives and recommendations/requirements of various documents/plans when developing the strategy and identifying opportunities.

Feedback received	Action taken
- Suggested consideration of and references to documents and plans provided.	- Data regarding designated sites has been obtained and additional data advised by LWT.
Natural England	
- Environmental baseline information included within scoping report provides sufficient information on the natural environment. - Satisfied that the relevant external policies, plans and programs identified within scoping report cover our interests in the natural environment. - Consider that the issues and receptors have been correctly identified within the scoping report. - Welcome Natural England being contacted to identify the requirement for and scope of the HRA. - Satisfied that the SEA objectives and assessment criteria are appropriate for the proposed strategy.	- No actions required.

Following scoping, environmental stakeholders were included in the workshops held in November 2016 and July 2017 as part of the wider engagement activities relating to the development and selection of flood risk management approaches and options and the potential identification of environmental opportunities and improved outcomes.

During the HRA process, two Discretionary Advice Service meetings were held with Natural England on 27th November 2017 and 7th December 2018 to discuss the proposed scope, content and output of the HRA. An initial draft of the Stage 1 likely significance test/screening assessment was used as the focus of the first meeting, and key discussion points are provided in Appendix A.

5.4 Future engagement activities

The recommendations of the draft Strategy and the SEA Environmental Report have been informed by the extensive stakeholder and public engagement activities undertaken throughout the development of these documents. Formal consultation will take place from 3 June to 25 August 2019 to seek the views of stakeholders and the general public. This formal consultation will comprise the following activities:

- A minimum of three public drop-in events at locations between Saltfleet and Gibraltar Point.
- An E-consultation via consultation website (citizen space), along with option of postal consultation.
- Draft Strategy and SEA Environmental Report (and associated supporting information) to be available at local libraries and community centres and advertised accordingly.
- Awareness raising of this consultation via:
    - Attendance at local events to raise awareness of up-coming consultation – e.g. 999 Day (Skegness), Resilient communities conference (Lincoln) and Furlongs Festival (Sutton on Sea).

- Invitations to parish/town councils and community groups to talk/present around the draft strategy.
- Strong presence on social media using Environment Agency area twitter account.
- Press release to be issued to inform media channels.
- Details of consultation to be looped on the display at the North Sea Observatory at Chapel Point).

Following completion of the formal consultation, all responses will be reviewed and any actions/changes required considered and undertaken, including any changes to the strategy proposals prior to it being finalised and if required, any additional assessment during the SEA process. Proposals for future consultation relating to the SEA process are included in Section 8.4.

6. Assessment of the proposed strategy

6.1 Introduction

This section presents a strategic-level assessment of the proposed coastal flood risk management strategy for the Lincolnshire coast between Saltfleet and Gibraltar Point. This assessment considers the potential effects of the proposals recommended in the strategy to sustain the present standard of flood risk management in line with predicted sea level rise in the short (0 to 5 years hence, nominally up to 2025 – stage 1), medium (6 to 35 years hence, nominally 2026 to 2055 – identified as two stages, 2 and 3) and long term (36 to 100 years hence, nominally 2056 to 2120).

The proposals assessed in the short term are to continue the present management approach of annual beach nourishment and associated activities in Zone B (Figure 2.1) to protect and sustain the existing landward sea defences in line with sea level rise.

In the medium to long term, althougn the proposed strategy identifies a preferred approach, there is inherent uncertainty regarding the timing and type of actions that will be taken to implement the strategy which will largely be dependent upon the availability of funding, future climate change and other triggers. To address this and ensure a reasonable 'worst case' 'do something' position is considered whatever the future outcome, this assessment considers two potential scenarios, principally in Zone B, as described in Section 2.6, based on the design assumptions in Appendix D:

(1) the retention of an open beach and the continuation of the present regime of annual beach nourishment, with volumes increasing to sustain the present standard of protection over time in line with predicted sea level rise; or

(2) the phased introduction of a series of rock structures, principally rock groynes and or potentially fishtails, along the coast, that will reduce sand losses and require reduced volumes of beach nourishment.

Both scenarios are likely to also require the raising and widening of the landward sea defences in the longer term to provide an effective 'backstop' for the higher and wider beach and prevent the movement of sand landward. Some consideration is also made, as appropriate, of proposals in the longer term in Zones A and C, although this is minimal given the high level of uncertainty associated with these proposals.

The assessment considers the potential effects of the strategy proposals in terms of each of the nine topics and associated objectives/sub-objectives and 'scoped in' receptors set out in the appraisal framework described in Section 4.3.

Assessments are provided for all timeframes and both scenarios to represent a reasonable worst case position, compared with the present day conditions and taking into account future changes in the absence of the proposed strategy i.e. the baseline 'do nothing' situation. In accordance with the methodology described in Section 4.4 and assumptions in Section 4.5, the assessment identifies the potential effects, both beneficial and adverse, of the proposed strategy and where needed, recommends measures to mitigate identified adverse effects and actions to inform the future implementation of the strategy proposals. The residual effects of the strategy proposals, assuming this mitigation is successful, are then identified.

The assessment is structured and presented as follows for each of the nine topics considered within this SEA:

- The first sub-section sets out the relevant SEA objective(s) (from Table 4.2) under consideration and the specific types of receptors scoped into the assessment (for ease of reference – full details in Appendix H).
- The next sub-section describes the assessment of effects in terms of each of the 13 SEA objectives (that sit under the nine topics).
    - Firstly, the relevant sub-objective(s) and assessment criteria used for the assessment (from Table 4.2) are listed for ease of reference.
    - The subsequent assessment tables present the assessment of the strategy proposals/potential scenarios in the short term (the first table) and medium/long term (the second table, covering both scenarios) in terms of the relevant sub-objectives. The assessment tables list the relevant sub-objective number; describe the predicted effects of the proposals; determine the predicted significance of described effects in terms of Table 4.4 (and the criteria in Table 4.3); and identify whether mitigation measures or further actions are required during the future implementation of the strategy. There are separate sections and assessment tables for each objective. Note that the assessment of the scenario 1 and 2 proposals in the medium and long term identify the specific time periods for each identified effect only where different.
    - The next sub-section describes the mitigation measures and further actions recommended to address predicted effects in terms of each SEA objective. The actions described are classified in terms of each relevant sub-objective, strategy proposals/potential scenarios and timescale.

A summary of the predicted effects of the strategy proposals/potential scenarios across all timescales is then presented in Section 6.11.

The strategy proposals also have the potential to give rise to effects in terms of any synergies 'in combination' with other relevant plans or proposals. These are considered and identified in Section 6.12.

Finally, Section 6.13 sets out a proposed monitoring framework through which the effects of the implementation of the strategy can be measured and monitored – either by the avoidance, mitigation or management of predicted adverse effects or the delivery of environmental improvements/benefits.

6.2 Population, health and economy (Objectives 1 to 3)

6.2.1 Objectives

Objective 1: Manage risk to the health of people and local communities
Objective 2: Avoid damage to, and enhance where possible, recreation and tourism
Objective 3: Minimise risk to economic activities and facilitate the creation of economic opportunities

6.2.2 Receptors considered

Obj	Sub-topic	Receptors scoped in
1	Population and health	• Population and properties (up to 22,000[22] (20,000 residential and 2,000 commercial) at risk from a flood with a 0.5% probability of occurring in any one year), and an additional 24,500 seasonally occupied caravans, within the tidal floodplain. • Growing population, in particular the numbers of older people. Future viability of local communities at risk from flooding, particularly in rural locations.
	Social deprivation	• Localised areas of socially deprived and vulnerable communities (in particular in Mablethorpe and Skegness) whose quality of life is at risk from flooding and who may be affected by flood risk management actions.
2	Tourism and recreation	• Regionally important tourist facilities and attractions (e.g. beach, key tourist resorts, visitor attractions) along the coastal frontage and within the tidal floodplain at risk from flooding or flood risk management actions. Importance of retention of access to/use of amenity beach and nearby amenities to attract visitors. • Regionally and locally important recreational and amenity resources (e.g. footpaths (including the England Coast Path), promenade access, cycle routes, public/open spaces, recreation/sports grounds (e.g. golf courses), informal pursuits (e.g. bird watching, angling), Lincolnshire Coastal Country Park) along the coastal frontage and within the tidal floodplain at risk from flooding or flood risk management actions. • Consideration of opportunities to improve or create new attractions/resources and diversify the visitor experience/tourism offer.
3	Economic activity	Existing industry, commercial and economic activities at risk from flooding or potentially affected by flood risk management actions, with impacts on employment and the local economy. Key sectors include: – Agriculture – land within the tidal floodplain (*covered under Land use topic*). – Seasonal seaside tourism – significant contribution to local economy (accommodation, holiday parks, visitor attractions). – Commercial fisheries and shellfisheries in the adjacent waters and within The Wash, including beach-launched boats. – Other significant commercial activities and service industries. Consideration of potential opportunities to encourage additional investment and diversify the economy, overcoming seasonal limitations.

6.2.3 Assessment of potential effects

6.2.3.1 Objective 1: Population and health

6.2.3.1.1 Sub-objectives and assessment criteria

	Sub-objectives	Assessment criteria
1.1	Minimise the vulnerability of people and public health to tidal flooding	• *Do the proposals change the number of residential properties at risk from flooding from the present day?* • *Do the proposals change social vulnerability and deprivation in affected areas from the present day?* • *Do the proposals affect the viability of local communities?*

[22] Based on 2009 property counts, assuming that subsequent new developments are sufficient in terms of their own flood mitigation provision.

	Sub-objectives	Assessment criteria
1.2	Avoid risk to life through an adaptive approach	• *Do the proposals seek to manage future risks to properties through an adaptive approach?*

6.2.3.1.2 Assessment

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
1.1	The proposals will continue to sustain the present level of flood protection (to a 0.5% AEP, sustained in line with predicted sea level rise) to 22,000 residential/commercial properties and 24,500 seasonally occupied static caravans at risk from tidal flooding. This will provide considerable benefits to the local community (including any deprived or vulnerable communities) in the short term within the strategy area with the associated reduction in risk to life and benefits to health and wellbeing. The proposals will not directly reduce the level of any concentrated areas of deprivation of regional significance in Mablethorpe and Skegness or improve the viability of local communities. However, the assurance of continued reduction in flood risk in the short to long-term provided by the strategy will provide significant positive benefits at a regional scale to health and wellbeing amongst more vulnerable members of the communities at risk.	**++** *Perm, Rev, Reg, ST*	None required
1.2	Annual beach nourishment is an adaptive approach that in the short term can be designed and adjusted on an annual basis to respond to changing conditions (i.e. where beach levels have reduced or increased) to provide the required standard of protection in line with sea level rise.	**++** *Perm, Rev, Reg, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
1.1	As described in the short term, the proposals will continue to provide benefits to the health and wellbeing of the local population from sustaining the present level of flood risk reduction in the medium to long term. This will continue to benefit current areas of social deprivation and not compromise the viability of local communities. However, to continue to deliver this in the long term in line with predicted sea level rise, the extent of the nourishment activities along the coast will need to increase and the beaches and rearward seawalls will need to become both higher and wider to provide the same level of protection. The increasing reliance on the regular availability of large volumes of suitable nourishment material and associated increasing costs over time/availability of funding may reduce confidence in the long term effectiveness of the coastal flood risk management approach amongst the local community – with potential associated effects on health and wellbeing and an associated reduction in the significance of positive effects in the long term.	Medium term **++** *Perm, Rev, Reg, MT* Long term **+** *Perm, Rev, Reg, LT*	None required
1.2	Annual beach nourishment is an adaptive approach that in the medium term can continue to be designed on an annual basis to respond to changing	Medium term	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	conditions (i.e. where beach levels have reduced or increased) to provide the required standard of protection in line with sea level rise. In the long term, the adaptability of the proposal may be constrained by the availability of nourishment material and funding as the requirements increase to reflect actual sea level rise, reducing the potential significance of positive effects.	**++** *Perm, Rev, Reg, MT* Long term **+** *Perm, Rev, Reg, LT*	

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
1.1	The proposals to introduce rock structures along the coast in the medium term will continue to sustain the present level of flood risk reduction (to a 0.5% AEP, sustained in line with predicted sea level rise) to the residential/commercial properties and seasonally occupied static caravans at risk from tidal flooding. This change in approach will continue to provide considerable benefits to the local community in the medium term (including any deprived or vulnerable communities) with the associated reduction in risk to life and benefits to health and wellbeing. In the long term, the presence of the structures, potentially with increased dimensions to sustain the present standard of protection in accordance with sea level rise, will provide improved confidence amongst the affected population in the level of flood protection provided. This will provide continued benefits to health and wellbeing.	**++** *Perm, Rev, Reg, MT to LT*	None required
1.2	The introduction of rock structures in the medium term will require an upfront investment in terms of materials and funding. The proposal also allows for adaptive approach in the medium to long term. Whilst the structures will be designed to provide a target standard of protection in line with predicted sea level rise, these can also be adapted by adding to the dimensions of the structures and/or additional beach nourishment activities to sustain the present standard of protection in accordance with sea level rise.	**++** *Perm, Rev, Reg, MT to LT*	None required

6.2.3.2 Objective 2: Tourism and recreation

	Sub-objectives	**Assessment criteria**
2.1	Avoid damage to and loss of use of significant visitor attractions and recreational resources	• *Do the proposals help to maintain or improve amenity beaches and associated facilities, compared to the present day?* • *Do the proposals maintain or improve visitor attractions from the present day?*

		• *Do the proposals maintain, or improve, existing access and recreational provisions/facilities along the coast, compared to the present day?*
2.2	Support opportunities to attract investment in coastal tourism and improve visitor attractions and recreational resources	• *Do the proposals contribute to future regeneration of the tourism industry or improve formal or informal recreational facilities/opportunities?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
2.1	**Amenity beach:** Continuing annual beach nourishment in the short term with the same material as at present would maintain the existing high amenity value and open character of the existing beach. The status of the two Blue Flag beaches at Mablethorpe and Sutton-on-Sea within the nourishment area, and Skegness to the south, will not be compromised. No significant changes are predicted to the current excellent water quality of the classified Bathing Waters as a direct result of beach nourishment activities, which has previously been improved and maintained during the preceding decades of the annual beach nourishment regime. The continued attractiveness of the beach to visitors and tourists – including the dominant traditional family market – would bring continued benefits to the local seasonal tourism economy, particularly in the key traditional seaside resorts at Mablethorpe, Trusthorpe, Sutton-on-Sea, Sandilands, Chapel St Leonards, Ingoldmells and Skegness. Continued management of the landward seawall and promenade will protect the beachside facilities that support the beach-related tourism (e.g. beach huts, walkways etc.). There would continue to be disturbance and disruption for approximately two months on an annual basis as a result of the beach nourishment activities, but these are typically scheduled outside the peak holiday periods (in the spring, outside school holidays) to minimise impacts and over the past couple of decades have also become somewhat of an attraction. The timing of annual beach nourishment activities will need to continue to consider potential impacts on beach users.	**++** *Perm, Rev, Reg, ST*	Whilst overall significance is positive, actions are recommen-ded to mitigate some potential negative effects in the long term – see Section 6.2.4
	Tourism infrastructure at risk: Annual beach nourishment will continue to sustain a reduction in flood risk to holiday accommodation (including caravan parks, B&Bs, holiday lets and hotels), large and small holiday parks and entertainment centres such as Butlins and Fantasy Island and other tourist attractions and recreational assets/facilities (both formal and informal) within the tidal floodplain, protecting these key elements of the significant local tourism economy.	**++** *Perm, Rev, Reg, ST*	None required
	Recreation and access: Uninterrupted access along the coast will be maintained along the beach and the walkway/cycleway along the promenade/seawalls, including along the proposed route of the England Coast Path National Trail[23] (except temporarily during annual beach nourishment activities). Access to the beach from the hinterland will continue to be provided via access points in the seawalls that will continue to be maintained.	**++** *Perm, Rev, Reg, ST*	None required

[23] Proposed route between Mablethorpe and Skegness subject to public consultation in March 2017: https://www.gov.uk/government/publications/england-coast-path-from-skegness-to-mablethorpe-comment-on-proposals

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	Continued maintenance of an open beach will support existing recreational and leisure activities undertaken on/from the beach; in particular those that rely on the maintenance of large open spaces such as sand yachting.		
2.2	In providing a high value amenity beach and sustaining the present level of flood protection, the beach nourishment programme will continue to underpin the tourism economy of the strategy area. The strategy will not directly provide any additional opportunities for the diversification of the present traditional tourism sector; but it will provide improved confidence for investment by other parties and maintain the present range and diversity of habitats that provide opportunities for the future development of nature tourism.	**+** *Perm, Rev, Reg, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
2.1	**Amenity beach:** As described in the short term, continuing annual beach nourishment in the medium to long term with the same material as at present would continue to maintain the existing high amenity value and open character of the existing beach. However, over time the profile of the beach will be altered, becoming higher and wider with potentially a steeper slope down to the subtidal zone. This may affect the perceived potential amenity value of the beach in the long term. The status of the three Blue Flag beaches at Mablethorpe, Sutton-on-Sea and Skegness within the extended nourishment area are unlikely to be compromised and no significant changes are predicted to the current excellent water quality of the classified Bathing Waters as previously discussed as a direct result of beach nourishment activities. The continued attractiveness of the beach to visitors and tourists – including the dominant traditional family market – would bring continued benefits to the local seasonal tourism economy, particularly in the key traditional seaside resorts at Mablethorpe, Trusthorpe, Sutton-on-Sea, Sandilands, Chapel St Leonards, Ingoldmells and Skegness. However, as discussed above, there may be some perceived reduction in its attractiveness in the long term if the beach profile becomes more steeply sloping and activities such as bathing are considered to be more hazardous and consideration of such hazards will be required in the future. Continuing from the short term, there would also continue to be disturbance and disruption for approximately two months on an annual basis as a result of the beach nourishment activities, but these are typically scheduled outside the peak holiday periods (in the spring, outside school holidays) to minimise impacts and over the past couple of decades have also become somewhat of an attraction. The timing of annual beach nourishment activities will need to continue to consider potential impacts on beach users. In the medium term, continued management of the landward seawall and promenade will protect the beachside facilities that support the beach-related tourism (e.g. beach huts, walkways etc.). However, any increases in the	**+** *Perm, Rev, Reg, MT to LT*	Whilst overall significance is positive, actions are recommen-ded to mitigate some potential negative effects in the long term – see Section 6.2.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	dimensions of the landward sea walls/defences required in the long term to sustain the standard of protection may also affect the promenades and associated beachside facilities. Potential impacts on these assets will need to be managed.		
	Tourism infrastructure at risk: The programme of annual beach nourishment in the medium to long term will continue to sustain a reduction in flood risk to holiday accommodation (including caravan parks, B&Bs, holiday lets and hotels), large and small holiday parks and entertainment centres such as Butlins and Fantasy Island and other tourist attractions and recreational assets/facilities (both formal and informal) within the tidal floodplain, protecting these key elements of the significant local tourism economy.	++ *Perm, Rev, Reg, MT to LT*	None required
	Recreation and access: Uninterrupted access along the coast will continue to be maintained along the beach and the walkway/cycleway along the promenade/seawalls in the medium term, including along the proposed route of the English Coast Path National Trail. In the long term, any raising of the landward sea walls/defences is likely to directly affect these features, and provision will need to be made to maintain uninterrupted access along the coast and through access points to the beach through the sea walls/defences. Potential impacts on these assets will need to be managed and opportunities for improved access (including linkages from further inland) should be explored. Continued maintenance of an open beach will support existing recreational and leisure activities undertaken on and along the beach, although significantly increasing the height and width of the beach may create a steeper than at present profile that may in time compromise the usage of the beach for some recreational activities. This would result in an associated reduced significance in the long term.	Medium term **++** *Perm, Rev, Reg, MT* Long term **+** *Perm, Rev, Reg, LT*	Whilst overall significance is positive, actions are recommen-ded to mitigate some potential negative effects in the long term – see Section 6.2.4
	In the medium to long term, the presence of a higher beach may exacerbate an existing local management issue of windblown sand that may temporarily restrict access along the promenade walkway/cycleways. This issue will need to be managed, with these maintenance requirements increasing over time due to the presence of an increasingly higher beach and potential for increased storminess.	**X** *Temp, Rev, Local, ST*	
2.2	In providing a high value amenity beach and sustaining the present level of flood protection, the beach nourishment programme will continue to underpin the tourism economy of the strategy area. The strategy will not directly provide any additional opportunities for the diversification of the present traditional tourism sector; but it will provide improved confidence for investment by other parties in the medium to long term and maintain the present range and diversity of habitats that provide opportunities for the future development of nature tourism.	**+** *Perm, Rev, Reg, MT to LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
2.1	**Amenity beach:** The introduction of new cross-shore rock structures at intervals along the beach would alter the existing form and character of the beach, creating individual sections of beach between each structure (ranging from 200 m to 1 km in length, depending on the type and design of structures present). The resulting form of the beach will depend on the structures installed to create each section. If fishtail structures were introduced, the form of the beach between these structures would be altered from the present linear alignment to crescent shaped bays. The level of the beach is also likely to change with the build up of some material on the downdrift (northern) side of each rock groyne structure reflecting the dominant southern alongshore movement of material. Once the beaches stabilise following the introduction of structures and initial nourishment, the form of the beach, particularly in the 'hotspots', will be more consistent throughout the year and less likely to experience significant losses/reductions than at present. There may also be some depletion of beaches downdrift of the structures, which may need to be supplemented until the dynamic equilibrium of the coast is restored. The change in the form and character of the beach could affect the amenity value of the beach, although the nature and degree to which this would be considered significant would vary depending on how it is used and the perception of the user. Consultation undertaken with local stakeholders has indicated a preference for the introduction of larger structures (e.g. fishtail groynes) that would create more sheltered conditions for use of the beach and bathing waters by families and present an opportunity to create more defined spaces and conditions at popular beaches. Despite the permanent physical changes, the structures are likely to maintain the attractiveness of the beach to visitors and tourists – including the dominant traditional family market – and would bring continued benefits to the local seasonal tourism economy, particularly in the key traditional seaside resorts at Mablethorpe, Trusthorpe, Sutton-on-Sea, Sandilands, Chapel St Leonards, Ingoldmells and Skegness. There would also be a significant reduction in the disturbance and disruption associated with the beach nourishment activities, which would be reduced from an annual frequency to a potentially five-yearly basis. In the medium term, continued management of the landward seawall and promenade will protect the beachside facilities that support the beach-related tourism (e.g. beach huts, walkways etc.). In the long term, any increases in the dimensions of the landward sea walls/defences required in the long term to sustain the standard of protection may also affect the promenades and some facilities may be lost. Potential impacts on these assets will need to be managed. Despite the changes, the present status of the three Blue Flag beaches at Mablethorpe, Sutton-on-Sea and Skegness is unlikely to be compromised and no significant changes are predicted to the current excellent water quality of the classified Bathing Waters as a direct result of the proposals. The presence of defined lengths of beach framed by structures may improve beach safety in that boundaries can provide limits for children and also provide safer bathing areas. However, conversely, structures could diminish visual supervision, by a parent or guardian, if limits of exploration are ignored.	**+** *Perm, Rev, Reg, MT to LT*	Whilst overall significance is positive, actions are recommen-ded to mitigate some potential negative effects in the long term – see Section 6.2.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	Rock structures also provide climbing challenges for members of the public. Although climbing of structures can be dissuaded by appropriate signage, this is often difficult to enforce. As with all cases of large tidal frontages, provision would have to be made for access to each potentially tide locked area, thereby removing the risk of being trapped by rising water levels.	**X** *Perm, Rev, Local, LT*	Yes – see Section 6.2.4
	Tourism infrastructure at risk: Landward of the beach and sea defences, the introduction of rock structures and associated reduced level and frequency of beach nourishment in the medium to long term will continue to sustain the present level of flood protection to holiday accommodation (including caravan parks, B&Bs, holiday lets and hotels), large and small holiday parks and entertainment centres such as Butlins and Fantasy Island, and other tourist attractions and recreational assets/facilities (both formal and informal) within the tidal floodplain, protecting these key elements of the significant local tourism economy.	**++** *Perm, Rev, Reg, LT*	None required
	Recreation and access: The structures, particularly if fishtail groynes are included, could interrupt access along the beach at all states of tide, although the structures can be designed to allow vehicular and step-free pedestrian access at the top of the beach where these adjoin the sea wall/bank/natural defences. On this basis, access along the coast can be maintained along the top of the beach and the walkway/cycleway along the promenade/seawalls in the medium term, including along the proposed route of the England Coast Path National Trail. However, access along the beach at the waterline between beach sections may not be possible if fishtail structures are introduced and only the lowest states of tide where rock groynes are present. As in scenario 1, in the long term, any raising of the landward sea walls/defences is likely to directly affect these features, and provision will need to be made to maintain uninterrupted access along the coast and through access points to the beach through the sea walls/defences. Opportunities for improved access (including linkages from further inland) should be explored. The groyne structures will be designed to effectively perform as control structures to reduce sediment losses from the existing beach. However, they will not include any additional features that may be of value to tourism and leisure – although there may be opportunities for third parties to consider potential options, subject to the provision of third party funding. The presence of the structures will not adversely affect all recreational features on the beach, but the length of open beach will be limited to a potential maximum length of 1 km (between fishtail groynes if introduced, or 200 m between rock groynes) which may limit some existing activities that require a long length of open beach.	**X** *Perm, Rev, Reg, LT*	Yes – see Section 6.2.4
2.2	In providing a high value amenity beach and sustaining the present level of flood protection, the beach nourishment programme will continue to underpin the tourism economy of the strategy area. The strategy will not directly provide any additional opportunities for the diversification of the present traditional tourism sector; although it will provide improved confidence for investment by other parties in the medium to long term and maintain the present range and diversity of habitats that provide opportunities for the future development of nature tourism.	**+** *Perm, Rev, Reg, MT to LT*	None required

6.2.3.3 Objective 3: Economic activity

	Sub-objectives	Assessment criteria
3.1	Minimise the vulnerability of areas of significant employment/economic activity to tidal flooding	• *Do the proposals change the level of risk to areas of significant employment or economic activity?*
3.2	Ensure compatibility with planned development and regeneration	• *Are there conflicts between the proposals and ongoing/planned development?*
3.3	Support and facilitate the creation of economic opportunities	• *Could the proposals generate future employment/development opportunities?*
3.4	Avoid damage to commercial fishing activity and shellfisheries	• *Do the proposals affect commercial fishing/shellfisheries activity (e.g. by affecting important fisheries, restricting access to fishing grounds or presenting risks to water quality) in The Wash and offshore waters?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
3.1	The proposals will continue to sustain the present level of flood protection in the short term (to a 0.5% annual chance of occurring, sustained in line with predicted sea level rise in the short term) to 22,000 residential/commercial properties, 24,500 seasonally occupied static caravans and areas of employment/economic activity within the tidal floodplain at risk from tidal flooding. This will provide considerable benefits to the local economy by continuing to avoid any direct economic losses or disruption resulting from flooding. The economic benefits in relation to tourism are discussed under Objective 2.	**++** *Perm, Rev, Reg, ST*	None required
3.2	There are no known conflicts between the short term programme of annual beach nourishment and other known potential planned development set out in the adopted ELDC Local Plan within the strategy area. Apart from access provisions and site compounds, the beach nourishment activities will be limited primarily to the beach frontage – and the principal interface will be with any proposed infrastructure landings from offshore developments planned in the short term (to the north of Anderby Creek (e.g. Triton Knoll) and potentially to the south of Sandilands (Viking Link)) – further consideration is made under sub-objective 4.2. Consideration of such interfaces will be required as the strategy is implemented. Potential effects are considered to be neutral.	**N**	No mitigation required – but actions recommend ed in Section 6.2.4
3.3	The proposals will not provide any specific opportunities for economic development in the short term; but as described above, in sustaining the present level of flood protection, it will indirectly support present and future economic development within the floodplain by stimulating investor confidence and removing barriers to investment. However, given the short term duration, potential effects are considered to be neutral.	**N**	None required
3.4	Previous studies[24] have reported no evidence correlating nourishment activities with an adverse impact on epibenthic or demersal fisheries. The brown shrimp (*Crangon*) fishery in The Wash accounts for a substantial portion of UK brown shrimp landings. The 2017 environmental monitoring	**N**	No mitigation required – but actions

[24] Environment Agency (2018) Lincshore 2010-2017: Environmental Annual Monitoring Report 2017, published by the Environment Agency Estuarine and Coastal Monitoring and Assessment Service. Environment Agency (2016b) Lincshore 2016-2020 Environmental Statement January 2016, published by the Environment Agency

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	(Environment Agency, 2018) identified that, as has been the case in recent years, epifaunal assemblages surveyed along the coastal waters within the strategy area were dominated by brown shrimp, with abundances particularly high at inshore sites. Within these near shore sites, abundances were significantly higher within the nourishment zone than those to the south of the nourishment zone. Therefore, there were no apparent differences that indicated that beach nourishment activity was impacting on epifaunal assemblages. In addition, there was also no apparent temporal trend in the data over time (2010-2017) with regards to the nourishment regime. On this basis, no effects are anticipated, although the continuation of the present monitoring regime, adapted as needed, is recommended. Potential effects are considered to be neutral.		recommend ed in Section 6.2.3
	However, depending on the timing of the works there is limited potential to cause some disruption to fisheries through potentially limiting access to beach launching sites and nearshore fishing grounds; particularly in relation to the established brown shrimp fishery along the nearshore waters of the strategy area and potting for crab, whelk and lobster. Consideration of potential impacts will be required during the future development and implementation of the strategy; with actions recommended in Section 6.2.3.	**X** *Perm, Rev, Local - Reg, ST*	Yes – see Section 6.2.3
	As has occurred in the preceding decades of beach nourishment, there will be continued losses of sand from the coastal frontage, with some uncertainty in relation to the offshore movement and potential deposition of this material. In recent years concerns have been raised regarding any effects of sediment from beach nourishment and changes to offshore areas, potentially impacting, in particular, on fishing activities and shellfisheries offshore and downdrift into The Wash. In developing the strategy, a number of previous studies[25] have been examined and these show that the behaviour of banks and channels in this area has been very dynamic since at least the earliest Ordnance Survey maps and Admiralty Charts of the early 1800s, i.e. well before the current beach nourishment activities. Studies following the commencement of nourishment concluded that whilst some depth changes could be identified, it was not possible to directly associate these with the Lincshore scheme, and that the banks had generally accreted over time. Detailed monitoring found that although changes in the banks and channels could be identified, the “large changes in the volume of the Skegness Banks cannot wholly be a result of the Lincshore beach nourishment works”, concurring with previous analysis from surveys where the volume increase in the banks was noted to be “more than twice the volume of material placed on the beach during the whole of the works” and “is …. fourteen times the amount of material ‘lost’ from the beach”. On this basis, whilst there is no evidence of a direct linkage between the present and historic beach nourishment scheme and any changes to the annual yields from fisheries and shellfisheries offshore and downdrift, there remains some residual concerns amongst the fishing community based on the uncertainty relating to the ultimate fate of the nourishment material lost from the frontage. On this basis, continued consideration and monitoring is recommended as the strategy is further developed and implemented.	**N**	No mitigation required – but actions recommend ed in Section 6.2.3

[25] References cited in CH2M (2018)

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	To meet the requirements of the current marine licence for the Lincshore 2016-2020 beach nourishment scheme, the annual environmental monitoring report (Environment Agency 2018) has analysed the available data currently available from the Eastern IFCA. This indicates that there is no evidence that cockle stocks in The Wash are being impacted by the Lincshore nourishment scheme. Cockle stocks in Wrangle and Friskney flats have been generally consistent since 2004. In addition, stock estimates for the Wrangle and Friskney beds have been reasonably close to the overall mean total estimate for The Wash between 1983 and 2010 (3,736 tonnes). Therefore, there was no relationship between cockle stocks and the volume of nourishment material deposited as part of the Lincshore scheme. On this basis, no additional impacts are anticipated in the short term. Overall, potential effects are considered to be neutral.		

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
3.1	As described in the short term, the proposals will continue to sustain the present level of flood risk reduction in the medium to long term (to a 0.5% AEP, sustained in line with predicted sea level rise) to 22,000 residential/commercial properties, 24,500 seasonally occupied static caravans and areas of employment/economic activity within the tidal floodplain at risk from tidal flooding. This will provide considerable benefits to the local economy by continuing to support the reduction in potential direct economic losses or disruption resulting from flooding in the medium to long term – with permanent positive effects on a regional scale in the medium to long term that can be reversed if needed. The economic benefits in relation to tourism are discussed under Objective 2.	**++** *Perm, Rev, Reg, MT to LT*	None required
3.2	As described in the short term, there are no known conflicts between the continuing programme of annual beach nourishment and other potential planned development (as identified in terms of proposals in the adopted ELDC Local Plan) within the strategy area in the medium to long term. Apart from access provisions and site compounds, the beach nourishment activities will be limited primarily to the beach frontage – and the principal interface will be with any proposed cable landings from offshore developments planned in the medium to long term (e.g. potentially to the south of Sandilands (Viking Link)) – further consideration is made under sub-objective 4.2. As described in the short term, consideration of such interfaces will be required as the strategy is implemented. However, in the long term, there could potentially be some direct impacts on land situated immediately landward of the rearward sea defences if the seawalls are raised and widened, encroaching on these areas, with potential economic impacts. Overall, potential effects are considered to be neutral.	**N**	No mitigation required – but actions recommend ed in Section 6.2.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
3.3	The proposals will provide a level of certainty in terms of sustained flood risk management in the medium to long term; providing confidence for economic investment within the floodplain on a longer term basis – particularly in terms of the tourism economy. This supports the objectives for the protection of the local economy and potential future economic development in the adopted ELDC Local Plan. However, conversely, the increasing reliance on the regular availability of large volumes of suitable nourishment material and associated increasing costs over time/availability of funding may reduce confidence in the effectiveness of the coastal flood risk management approach in the longer term amongst the local population and reduce investor confidence – with potential associated effects on economic investment. The proposals will not provide any specific opportunities for economic development; although as described above, will provide a sustained flood protection that would contribute to facilitating economic development within the floodplain in the medium to long term.	Medium term **++** *Perm, Rev, Reg, MT to LT* Long term **+** *Perm, Rev, Reg, MT to LT*	None required
3.4	As described in the short term, previous studies have reported no evidence correlating nourishment activities with an adverse impact on epibenthic or demersal fisheries. Further, there is unlikely to be any adverse impacts associated with the recycling activities. As described in the short term, there is no evidence of a direct linkage between the present and historic beach nourishment scheme and any changes to the annual yields from fisheries and shellfisheries offshore and downdrift. However, there remains some uncertainty in the medium to long term as the volume of material dredged and placed on the beaches increases, with potential associated increases in losses of material downdrift. On this basis, increased understanding of the potential movement and fate of nourishment material is recommended, through continued analysis and monitoring. In addition, the potential requirement for new sources and greater volumes of nourishment material in the longer time, which may differ in grain size or be more distant from the coastal frontage, increases the potential interaction with fishing activities and risk of potential disturbance to benthic and demersal fish species. Potential impacts are uncertain and will need to be considered further.	**?**	Yes – see Section 6.2.4
	However, depending on the timing of the works there is the potential to cause varying degrees of disruption to the fisheries through limiting access to beach launching sites and nearshore fishing grounds, that can be reversed if needed through alternative design/construction.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.2.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
3.1	The introduction of rock structures along the coastal frontage in the medium term will continue to sustain the present level of flood protection in the medium to long term (to a 0.5% AEP, sustained in line with predicted sea level rise) to 22,000 residential/commercial properties, 26,000 seasonally occupied static caravans and areas of employment/economic activity within the tidal floodplain at risk from tidal flooding. This will provide considerable benefits to the local economy by avoiding any direct economic losses or disruption resulting from flooding in the medium to long term. The economic benefits in relation to tourism are discussed under Objective 2.	**++** *Perm, Rev, Reg, LT*	None required
3.2	There are no known conflicts at present between the proposals to introduce new rock structures and other potential planned development (as identified in terms of proposals in the adopted ELDC Local Plan and any future development planning documents) within the strategy area in the medium to long term. Apart from access provisions and site compounds, construction of the rock structures will be limited primarily to the beach frontage so the potential interface with development is limited. However, the Lincolnshire coast is an area where various offshore developments are proposed and there would be potential interface between the strategy proposals and any proposed landfall infrastructure planned in the medium to long term (e.g. potentially to the south of Sandilands (Viking Link)). Consideration of such interfaces will be required as the strategy is implemented. However, in the long term, there could potentially be some direct impacts on land situated immediately landward of the rearward sea defences if the seawalls are raised and widened, encroaching on these areas, with potential economic impacts – this is considered under sub-objective 9.2. Overall, potential effects are considered to be neutral.	**N**	No mitigation required – but actions recommend ed in Section 6.2.4
3.3	The introduction of rock structures along the coastal frontage will provide a level of certainty in terms of sustained flood risk management in the medium to long term; providing confidence for economic investment within the floodplain on a longer term basis – particularly in terms of the tourism economy. This supports the objectives for the protection of the local economy and potential future economic development in the adopted ELDC Local Plan. In the long term, the continued presence of the structures, potentially with increased dimensions to sustain the present standard of protection in accordance with sea level rise, will provide improved confidence amongst the affected with potential associated benefits to the economy.	**++** *Perm, Rev, Reg, LT*	None required
3.4	The introduction of rock structures in the medium term could have some potential direct impacts on commercial fishing activities in the nearshore waters along the coastal frontage within the strategy area. Whilst rock groynes are not likely to extend beyond the MLWS level (low water) (structures anticipated to be approximately 150 m to 200 m long); if fishtail structures are introduced, these could be approximately 300 m in length and will extend beyond the MLWS level. The presence of these large structures could present a new hazard to navigation for fishing boats and potentially affect the fishing grounds for boats fishing close to the shore. The footprint of rock structure and changes to the patterns of erosion and deposition may reduce the habitat available for commercially exploitable stocks of brown shrimp.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.2.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	As described in the short term for scenario 1, compared with the preceding decades of beach nourishment, the structures will reduce present losses of sand from the coastal frontage, commensurate with reduction in nourishment volumes required. This may address some concerns expressed in recent years regarding changes in the pattern of sediment and impacts on the fishing industry and shellfisheries within The Wash, athough there are no proven links between nourishment and fisheries yields, as discussed under scenario 1. However, there remains some uncertainty and the recommendation is for further modelling and assessment during the development of the works arising from the strategy. Potential impacts are uncertain and will need to be considered further.	**?**	Yes – see Section 6.2.4

6.2.4 Mitigation recommendations and further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on population and health predicted during the future implementation of the strategy proposals described in Section 6.2.2. These actions are described in terms of relevant scenarios/proposals and time periods.

Objective 1: Population and health

No mitigation measures or further actions required as this objective is met for both scenarios in the short, medium and long term.

Objective 2: Tourism and recreation

Sub-objective 2.1: Protect visitor attractions and recreational resources

Continuing present management/beach nourishment (in the short, medium and long term):

- Continued appropriate timing of beach nourishment operations in all time periods to minimise disturbance to beach users and attractiveness to visitors and tourists.
- Consider potential hazards and reductions in quality of amenity provided by the beach as a result of the steeper than at present profile that is likely to result from beach nourishment activities in the long term – including associated increased hazards for bathing in the long term, including at Blue Flag beaches. Popular beaches may require frequent reprofiling of the beaches (whilst still sustaining the required standard of protection) to soften the profile and ease water access, especially during holiday periods.
- The planning and design of the proposals for raising the landward sea defences would also need to maintain and enhance existing connections with roads or footpaths/public rights of way to improve access to the beach from inland and reduce reliance on access by car/parking on the coastal strip (also applies to scenario 2).
- Continued ongoing maintenance and management of windblown sand will be required to maintain safe access along walkways/cycleways on the landward promenade.

Introducing new rock structures (in the medium to long term):

- The planning and design of the proposals for raising the landward sea defences for both scenarios in the long term will need to manage impacts on affected recreational assets (promenade/walkway/cycle path/amenity areas/beach huts etc.).
- The planning and design of new rock structures needs to provide for uninterrupted vehicular and pedestrian access at the top of the beach where these adjoin the sea wall/bank/natural defences – by allowing a gap between the cross-shore rock groynes and the landward sea defences.
- The planning and design of new rock structures should be undertaken in consultation with all beach user groups to minimise impacts on existing uses and seek opportunities for new or replacement activities.
- Potential need for topping up of beaches downdrift of new structures (scenario 2) in the medium term to protect the amenity value of these beaches until the equilibrium of the coast re-stabilises. As with all cases of large tidal frontages, provision would have to be made for access to each potentially tide locked area, thereby removing the risk of people being trapped by rising water levels.

Sub-objective 2.2: Support opportunities to attract investment

No mitigation measures or further actions required as this sub-objective is met for both scenarios in the short, medium and long term.

Objective 3: Economic activity

Sub-objective 3.1: Reduce flood risk

No mitigation measures or further actions required as this sub-objective is met for both scenarios in the short, medium and long term.

Sub-objective 3.2: Compatibility with planned development

Both scenarios in the short, medium and long term:

- Although no significant developments are known at the present time, some consideration for additional leisure facilities (e.g. a marina development) along this coastal frontage is being investigated. There will be a continuing need to review whether any developments/infrastructure are proposed along the frontage during the planning and design of annual nourishment operations or the installation of structures.
- Consultation will be required with LCC, ELDC, offshore windfarm and infrastructure operators and proponents to identify any potential interfaces, issues and opportunities. Two such interfaces would be the planned/proposed cable landings for the Triton Knoll offshore windfarm and the Viking cable link between the UK and Denmark, set to make landfall within Zone B.

Sub-objective 3.3: Creation of economic opportunities

No mitigation measures or further actions required as this sub-objective is met for both scenarios in the short, medium and long term.

Sub-objective 3.4: *Commercial fisheries*

Both scenarios in the short, medium and long term:

- Under the terms of the present marine licence (2016-2020) for the Lincshore beach nourishment scheme, there are a range of conditions relating to the management of potential impacts on fisheries, both within and outside the strategy area. These comprise: formal notification of the timing of works to mariners' and fishermen's organisations; appointment of a Fisheries Liaison Officer (FLO) to liaise with the

fishing industry and minimise potential conflicts; liaison with the local MMO office at Grimsby throughout the works to ensure minimal interference with fishery interests; appointment of an Engagement Officer to maintain regular communication with fisherman local to the works and the Eastern IFCA to identify the latest known shellfish beds; and annual monitoring (see Section 6.13) to record beach sediments, benthic and epibenthic invertebrates communities/populations and analyse shellfish bed data from the Eastern IFCA.

- Although setting out such specific mitigation is not appropriate at this strategic level, the principle of continuing engagement with the relevant authorities (the MMO and Eastern IFCA); regular communications with local fishermen through the most appropriate channels; and continued monitoring/data analysis will be central to the avoidance or management of potential impacts on fisheries from both proposed scenarios in the short, medium or long term.

Key mitigation recommendations comprise:

- Appropriate timing of annual nourishment operations or the installation of structures to avoid/minimise disturbance to fishing activities during peak fishing periods, particularly for the brown shrimp fishery in the nearshore waters.
- Continued proactive engagement by the Environment Agency with relevant authorities (the MMO and Eastern IFCA) and the local fishing community to understand their concerns and seek to minimise impacts. Continuation of such dialogue is recommended during the future implementation of the strategy, particularly during the planning and design of any structures proposed to be introduced.
- The modelling, planning and design of rock structures should seek to, as far as possible, reduce the footprint of structures and model any potential physical geomorphological changes and associated downdrift effects on fisheries.
- If needed, alternative access arrangements for beach-launched craft should be investigated through consultation with potentially affected fishermen to minimise the adverse effects of the works.
- Environmental monitoring should be continued as described in Section 6.13.

6.3 Material assets (Objectives 4 and 5)

6.3.1 Objectives

Objective 4: Minimise risk to infrastructure.
Objective 5: Use resources sustainably.

6.3.2 Receptors considered

Obj	Sub-topic	Receptors/opportunities scoped in
4	Transport infrastructure	• Key transport routes (e.g. A-roads and local roads) within the strategy area at risk from flooding or potentially affected by flood risk management actions.

Obj	Sub-topic	Receptors/opportunities scoped in
	Critical infrastructure and commercial/ industrial services	• Critical infrastructure and services (e.g. access for emergency services/lifeboats, power/water infrastructure/facilities e.g. Theddlethorpe gas terminal), existing/proposed windfarm cable landings/connections, (e.g. the proposed Viking Link) within the strategy area at risk from flooding or potentially affected by flood risk management actions.
5	Availability of finite resources e.g. building materials	• Long term sustainability and available supply of required materials to construct structures or nourish beaches.

6.3.3 Assessment of potential effects

6.3.3.1 Objective 4: Infrastructure

	Sub-objectives	Assessment criteria
4.1	Minimise the vulnerability of transport infrastructure to tidal flooding	• *Could the proposals conflict with or change the risk of flooding to key transport routes (roads) from the present day?*
4.2	Avoid damage to, or loss of, critical services/infrastructure	• *Could the proposals conflict with or change the risk of flooding to critical services/infrastructure from the present day?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
4.1	The annual programme of beach nourishment in the short term will continue to sustain the present level of flood protection to all transport infrastructure (strategic A roads (e.g. A52, A158, A111, A1031) and local roads) within the tidal floodplain. Given the dispersed nature of the population and settlements at risk and the associated reliance on road transport (whether by private car or public transport), this will continue to provide significant social and economic benefits in the short term.	**++** *Perm, Rev, Reg, ST*	None required
4.2	The annual programme of beach nourishment in the short term will continue to sustain the present level of flood protection to all critical infrastructure and services (i.e. power, water, waste water infrastructure, including the now decommissioned Theddlethorpe gas terminal) within the tidal floodplain. This will continue to protect and sustain the key services and functions that this infrastructure provides to the local community, with significant social and economic benefits in the short term.	**++** *Perm, Rev, Reg, ST*	None required
	The beach nourishment works will interface with existing and proposed cable landing sites (for wind farms (Lynn, Inner Dowsing, Triton Knoll); and power cables (e.g. Viking Link)) and drainage outfalls along the coastal frontage. There are also access points for the RNLI lifeboats stations at the Central Promenade in Mablethorpe and the Tower Esplanade in Skegness that extend across the beach. The proposals will need to take existing and proposed cable and outfall structures into account to ensure their function is not impaired and maintain clear access for lifeboats at Mablethorpe and Skegness in any areas of beach nourishment, in liaison with the relevant asset owners or proponents.	**X** *Perm, Rev, Reg, ST*	Yes - see Section 6.3.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
4.1	As described in the short term, continuing the annual programme of beach nourishment in the medium to long term will sustain the present level of flood protection to all transport infrastructure (strategic A roads (e.g. A52, A158, A111, A1031) and local roads) within the tidal floodplain. Given the dispersed nature of the population and settlements at risk and the associated reliance on road transport (whether by private car or public transport), this will continue to provide significant social and economic benefits in the medium to long term	**++** *Perm, Rev, Reg, LT*	None required
	In the long term, there could potentially be some direct impacts on local roads where these are situated immediately rearward of the sea defences. For example, if the seawalls are raised and/or widened to contain raised beach levels in the future, these may encroach on adjacent roads. If elevated beaches are not contained at the landward extents, wind blown sand could also present an issue for roads immediately behind the sea defences.	**X** *Perm, Rev, Local, ST*	Yes – see Section 6.3.4
4.2	As described in the short term, continuing the annual programme of beach nourishment in the medium to long term will sustain the present level of flood protection to all critical infrastructure and services (power, water, waste water etc.) within the tidal floodplain. This will continue to protect and sustain the key services and functions that this infrastructure provides to the local population, with significant social and economic benefits in the medium to long term.	**++** *Perm, Rev, Reg, LT*	None required
	As described in the short term, the beach nourishment works will interface with existing and proposed cable landing sites, drainage outfalls and access points for RNLI lifeboat stations along the coastal frontage. In the medium to long term, the proposals will need to take existing and proposed structures into account to ensure their function is not impaired and maintain clear access for lifeboats in any areas of beach nourishment or improvements to landward sea defences, in liaison with the relevant asset owners or proponents.	**X** *Perm, Rev, Reg, MT-LT*	Yes – see Section 6.3.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
4.1	The proposals to introduce rock structures along the coast in the medium term will sustain the present level of flood protection to all transport infrastructure (strategic A roads (e.g. A52, A158, A111, A1031) and local roads) within the tidal floodplain in the medium to long term. As for the open beach scenario, given the dispersed nature of the population and settlements at risk and the associated reliance on road transport (whether by private car or public transport), this will continue to provide significant social and economic benefits in the medium to long term.	**++** *Perm, Rev, Reg, LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	In the long term, similar to the open beach scenario, there could potentially be some direct impacts on local roads where these are situated immediately rearward of the sea defences. For example, if the seawalls are raised and/or widened to contain raised beach levels, these may encroach on adjacent roads. If elevated beaches are not contained, wind blown sand could also increasingly present an issue for roads immediately behind the sea defences.	**X** *Perm, Rev, Local, ST to LT*	Yes – see Section 6.3.4
4.2	The proposals to introduce rock structures along the coast in the medium term will sustain the present level of flood protection to all critical infrastructure and services (power, water, waste water etc.) within the tidal floodplain. This will continue to protect and sustain the key services and functions that this infrastructure provides to the local population, with significant social and economic benefits in the medium to long term.	**++** *Perm, Rev, Reg, LT*	None required
	Introducing the proposed rock structures along the coast in the medium term will interface with existing and proposed cable landing sites, drainage outfalls and access points for RNLI lifeboat stations along the coastal frontage. The design and siting of the proposed rock structures will need to take existing and proposed infrastructure (cable landings, drainage outfalls) into account to ensure their function is not impaired and maintain clear access for lifeboats, in liaison with the relevant asset owners or proponents. These considerations will also apply to any associated infrequent beach nourishment in the medium term and in the long term, improvements to landward sea defences. Given the time lag before these structures could be introduced, there may be opportunities to plan and design the integration of any new future infrastructure with the proposed rock structures.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6. 3.4

6.3.3.2 Use of resources (Objective 5)

	Sub-objective	**Assessment criteria**
5.1	Minimise the consumption of finite materials	• *Do the proposals require the use of significant volumes of finite materials? Are these readily available?* • *Do the proposals require the sourcing of and regular input of finite materials over the lifetime of the strategy?* • *Are there any constraints on the availability of materials required? Do the proposals allow flexibility for the sourcing of alternatives?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
5.1	The proposed approach will require the annual sourcing and use of a large volume of sand material, sourced from licensed offshore sandbanks in the North Sea, to undertake a proactive programme of beach nourishment and replenish any losses since the previous year's nourishment.	**X** *Perm, Rev, Reg, ST*	Yes – see Section 6.3.4

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual beach nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	At present, in order to sustain the required standard of flood protection (reflected in the measured volume of the beach providing protection to the landward sea defences), a volume of between 400,000 and 500,000 m^3 is dredged and placed on the beaches of the coastal frontage on an annual basis. In the short term (assumed five year period), the proposed approach will require the sourcing of an estimated total volume of approximately 2.3 million m^3, subject to the actual annual losses experienced which will be monitored each year. At present, it is anticipated that these volumes are available from existing licensed sources in the North Sea in the short term. However, the proposals will require the removal and redistribution of material within the sediment system, which may result in physical changes to the coastal morphology, although this should not be any different to the current baseline.		

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
5.1	As described in the short term, the proposed approach will require the annual sourcing and use of a large volume of sand material to undertake a proactive programme of beach nourishment and replenish any losses that have been eroded and transported offshore since the previous year's nourishment . The proposed approach will require the sourcing of an estimated total volume of approximately 19 million m^3 in the medium term (assumed 30 year period) and in the region of 64 million m^3 in the long term (assumed 65 year period), subject to the actual annual losses experienced which will be monitored each year, and the increasing volume of sand required to sustain the standard of flood protection in line with actual sea level rise. Compared with the short term, it is less clear whether these volumes of material will continue to be available from existing/future licensed sources in the North Sea – given the increasing legal protection for such sandbank habitats and the volumes of suitable material available from sources within a reasonable distance from the coastal frontage. The proposed approach is completely reliant on the sourcing of sufficient volumes of suitable sand material on an annual basis. Should this not be available in the longer term, then more distant sources of material will be required or alternative materials may need to be considered e.g. coarser materials. The proposals will require the removal and redistribution of significant volumes of material within the sediment system, which may result in other physical changes as discussed under sub-objective 7.2 (Section 6.5).	**XX** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.3.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
5.1	The proposed approach will require the sourcing and use of new finite resources (such as granite rock) to construct the rock armour and groyne structures. Subject to further design and depending on the type, number and dimensions of the structures required along the coast, this could require up to 600,000 m^3 of granite rock boulders in the medium term. The source of this rock is as yet unknown, but potential sources include Norway, hence this material could be transported to the coastal frontage by sea. In addition, there is a need for the sourcing and use of a significant volume of sand material to undertake supplementary beach nourishment to replenish any eroded losses until the coastline re-stabilises with the new structures in place – and, in the longer term, to respond to any increases in the beach volume to sustain the level of flood protection in line with sea level rise. However, given that the purpose of the rock structures is to hold sand in place along the shoreline, the volume of nourishment material required will be significantly less than in scenario 1 with an estimated total volume of approximately 7.5 million m^3 in the medium term (assumed 30 year period) and in the region of 18 million m^3 in the long term (assumed 65 year period). Although not as significant as scenario 1, the proposals will require the removal and placement of substantial volumes of rock (potentially from quarries in Norway) and the redistribution of sand material within the sediment system, with associated potential physical changes as discussed under sub-objective 7.2 (Section 6.5).	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.3.4

6.3.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on material assets predicted during the future implementation of the strategy proposals and described in Section 6.3.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Objective 4: Infrastructure

Sub-objective 4.1: Transport infrastructure

Both scenarios/proposals in the medium to long term:

- The planning and design of the proposals for raising the landward sea defences for both scenarios in the long term will need to minimise and manage any potential impacts on affected roads on the landward side. Liaison will be required with the relevant authorites (ELDC and LCC) and affected landowners.
- Continued ongoing maintenance and management of windblown sand will be required to maintain safe access along roads where hazards are created landward of the seawalls.

Sub-objective 4.2: Critical infrastructure and services

Both scenarios/proposals in the short, medium and long term:

- There is a need to review whether any developments/infrastructure are proposed along the coastal frontage/in affected areas during the planning and design of annual nourishment operations or the installation of new structures.

- Consultation will be required with ELDC, infrastructure operators and proponents to identify any potential interfaces, issues and opportunities.

Objective 5: Use of resources

Both scenarios/proposals in the short, medium and long term:

- The future design and implementation of the beach nourishment programme during the strategy implementation should optimise the volume of materials used through the design and placement of materials and appropriate use of construction plant and equipment.
- The future design of rock structures should be optimised to minimise the use of/need for materials, with consideration of a range of potential design/construction approaches, whilst providing the required standard of protection. Early consideration should also be given to the potential sources of suitable rock material (assumed at present to be Norway) and the future availability of these resources and sustainability of sourcing from suitable locations.
- A strategic assessment of the potential availability of suitable nourishment material from licensed offshore sources in the medium to long term should be undertaken at the outset of the strategy implementation to identify any potential availability constraints or issues in the future and identify potential alternatives.

6.4 Biodiversity (Objective 6)

6.4.1 Objectives

Objective 6: Maintain, and where possible, enhance flora and fauna

6.4.2 Receptors considered

Sub-topic	**Receptors/opportunities scoped in**
International/ national nature conservation sites	• Proposed or formally designated European sites (SACs, SPAs), Ramsar sites, MCZs, SSSIs and NNRs (including The Wash and North Norfolk Coast European Marine Site) between the Humber estuary and The Wash/North Norfolk Coast, including those offshore and inland within the coastal floodplain, at risk from flooding or potentially affected by flood risk management actions (Figure G.2). • Liaison will be undertaken with Natural England to identify the requirement for and scope of HRA of the strategy in relation to the European and Ramsar sites. • Consideration of potential opportunities for actions to contribute to maintaining/achieving favourable conservation or condition status.
Local nature conservation sites	• Locally important designated sites (i.e. LNRs, LWSs and SINCs (where still designated)) within the strategy area, at risk from flooding or potentially affected by flood risk management actions (Figure G.3). • Consideration of potential opportunities for actions to contribute to maintaining/achieving desired site status.

Sub-topic	Receptors/opportunities scoped in
Coastal/ terrestrial ecology	• Habitats of Principal Importance recorded within the coastal and terrestrial areas of the strategy area at risk from flooding or potentially affected by flood risk management actions (Figure G.4). • Consideration of impacts on specific legally protected species/those of conservation concern (e.g. Species of Principal Importance) known to be present along the coastal frontage within the strategy area, located outside of designated sites. • Consideration of potential opportunities for habitat creation/ improvement to benefit key habitats and species.
Marine/intertidal/ subtidal ecology and fish	• Benthic and epibenthic invertebrates, e.g. *Sabellaria*, of conservation concern/legally protected known to be present within the strategy area and located outside designated site boundaries and potentially affected by flood risk management actions, where information is readily available from monitoring/surveys (e.g. Environment Agency, 2018, in draft). • Fish and shellfish species, including nursery/spawning grounds, that are locally important (i.e. mainly shrimp, mussels and cockles), either within the strategy area or potentially affected by flood risk management actions, where information is readily available from existing monitoring/surveys. • Consideration of potential opportunities for habitat creation/improvement to benefit key habitats and species.

6.4.3 Assessment of potential effects

	Sub-objectives	Assessment criteria
6.1	Avoid damage to/loss of, and, where possible enhance, internationally and nationally designated sites of nature conservation interest	• *Do the proposals affect conservation/condition status of international or national nature conservation sites (SPA, SAC, Ramsar sites, MCZ, SSSI, NNR), or support achievement of conservation objectives, compared to the present day?*
6.2	Avoid damage to/loss of, and where possible enhance, locally designated sites of nature conservation interest	• *Do the proposals affect the condition of local nature conservation sites (LNR, LWS, SNCI) compared to the present day?*
6.3	Avoid damage to/loss of coastal and marine habitats and dependent species of conservation concern, where known to be present	• *Could the proposals damage or result in loss of Habitats of Principal Importance present within the strategy area?* • *Could the proposals affect Species of Principal Importance or known species of conservation concern, known to be present along the coastal frontage or in the coastal waters within the strategy area?*
6.4	Avoid disturbance and damage to fish/shellfish and their spawning/nursery grounds	• *Could the proposals affect fish/shellfish or their spawning/nursery grounds within the strategy area?*
6.5	Support opportunities to enhance biodiversity through habitat restoration or creation within the strategy area	• *Are there any opportunities for habitat restoration or creation?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
6.1	An HRA has been undertaken to assess the potential effects of the strategy on European sites (including Ramsar sites) in terms of the requirements of The Conservation of Habitats and Species Regulations 2017 (see the HRA in Appendix A). Details of this process are provided in Section 1.5. The HRA has identified that the proposed programme of annual beach nourishment works in the short term has potential for indirect effects on several European/international sites and their underpinning SSSI/NNR designations. Assessments of the preceding decades of beach nourishment have concluded that the sand eroded from the beaches along the coastal frontage is likely to be transported downdrift and offshore; with some likely accretion in the areas downdrift at Gibraltar Point and potentially, in The Wash. Whilst accretion is generally regarded as a positive process, especially for dune building, it can have negative effects if mud/sandflats are lost, shingle habitats are smothered or if it indirectly results in erosion of established dunes or saltmarsh. The latter is currently being observed at Gibraltar Point where accretion has led to the landward realignment of a main creek; although this is regarded by Natural England as part of the coastal processes. The deposition of material further south and into The Wash could result in potential impacts on some of the designated habitats and species of the European/national sites. Further details of historic and predicted changes are provided in Section 6.4 (sub-objective 7.2). The initial screening assessment undertaken as part of the HRA (Appendix A) concluded that there could be likely significant effects on some of the habitats and species of the following sites (affected features in brackets) as a result of the strategy proposals in the short-term: • Gibraltar Point SPA (little tern) • The Wash and North Norfolk Coast SAC and The Wash Ramsar site (sandflats; pioneer vegetation on mud; halophilous scrub and subtidal sandbanks) • The Wash SPA and Ramsar sites (qualifying bird species associated with coastal and estuarine habitats) These likely significant effects were then subject to further detailed assessment to consider whether they would result in an adverse effect on the integrity of these features and sites. The Appropriate Assessment (Appendix A) concluded that the short-term proposals would have no adverse impacts on the integrity of the above-named sites, with the implementation of appropriate mitigation and monitoring (see Appendix A and Section 6.4.4).	**X** *Perm, Rev, Reg, ST*	Yes – see Section 6.4.4
	The HRA (Appendix A) also identified that the works in the short term would have no direct or indirect effects on the following European/international designated sites and their underpinning SSSIs and NNRs, given the distance from the strategy area and/or the lack of any potential impact pathways: • The Humber Estuary (SPA, SAC, Ramsar) to the north of Zone A (all features) • The North Norfolk Coast (SPA, SAC, Ramsar) to the south east of Zone C (all features) • Near and offshore waters – the Greater Wash SPA and the Inner Dowsing, Race Bank and North Ridge Offshore SAC (all features) • Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC (all features)	**N**	No mitigation required – but actions recommend ed in Section 6.4.4

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	• Gibraltar Point SPA and Ramsar site (all features, except little tern) • The Wash and North Norfolk Coast SAC (*Sabellaria* reefs) • The Wash SPA and Ramsar site (qualifying bird species other than those associated with estuarine or coastal habitats) Overall, potential effects are considered to be neutral.		
	The annual programme of beach nourishment will continue to sustain the present level of flood protection in the short term to designated sites within the tidal floodplain – notably the Sea Bank Clay Pits SSSI; a set of former clay workings situated landward of the coast supporting uncommon aquatic plant communities, reedbeds and marginal wetland and an associated bird community. This will benefit these freshwater and terrestrial features that would be adversely affected by saline incursion – permanent positive effects on a regional scale in the short term that can be reversed if needed.	**++** *Perm, Rev, Reg, ST*	None required
6.2	The annual programme of beach nourishment will continue to sustain the present level of flood protection in the short term to non-designated sites within the tidal floodplain. This would benefit freshwater and terrestrial habitats within the wider floodplain with benefits to associated species, including areas of particular biodiversity value, such as local wildlife sites (LWS), sites of nature conservation importance (SNCI), areas forming part of the Coastal Country Park and the grazing marshes (part of the Lincolnshire Grazing Marsh Partnership), that rely on flood risk management for their conservation and support increasing levels of biodiversity and numbers of wetland birds (refer to Table 3.2 for details of sites). This is a permanent positive effect on a regional scale in the short term that can be reversed if needed.	**++** *Perm, Rev, Reg, ST*	None required
	There is potential for direct impacts on non-statutory sites of conservation value (LWS and SNCI) located along the coastal frontage, as a result of beach nourishment activities and access. LWSs include: Anderby Creek sand dunes, Huttoft Bank sand dunes, Chapel Point dunes, Sandilands golf course and dunes, Huttoft Car Terrace to Marsh Yard dunes. However, no adverse impacts have occurred in the preceding decades of beach nourishment – and any measures already in place to protect these sites can continue to be implemented. Notably, the presence of a higher and wider beach along the frontage provides additional erosion protection and benefits to the sand dunes along the coast, many of which are designated as LWSs. Overall, potential effects are considered to be neutral.	**N**	No mitigation required – but actions recommend ed in Section 6.4.4
6.3	As described for the non-statutory sites, there is potential for direct impacts on coastal and marine species of conservation concern (e.g. *Sabellaria spinulosa*) – where present along the coastal frontage/in nearshore waters outside the boundary of the marine SAC – as a result of beach nourishment activities and access. The intertidal and subtidal habitats and features for which the Lincs Belt recommended MCZ was considered for designation (but not designated) in Zones A and B (extends to the south of Sutton-on-Sea) have the potential to be directly and/or indirectly affected by the beach nourishment activities as a result of the physical changes to the beach frontage and shoreline in nourished areas and construction operations (e.g. the sinker line that conveys the dredged sand from the dredger to the beach). However, no adverse impacts have occurred in the preceding decades of beach nourishment – and any measures already in place to protect these	**X** *Perm, Rev, Reg, ST*	Actions recommend-ed in Section 6.4.4

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	habitats and species can continue to be implemented (e.g. appropriate placement of the sinker line that conveys the dredged sand from the dredger to the beach).		
	Continuing beach nourishment will have direct impacts on the intertidal and subtidal habitats and associated invertebrate communities. The invertebrate species recorded in the 2017 annual environmental monitoring (Environment Agency, 2018,) were similar to those recorded historically on the Lincolnshire coast, although a trend of decreasing species richness recorded throughout the monitoring zone in 2016 was still apparent in 2017. However, this was not restricted to areas affected by the Lincshore nourishment scheme and so it is possible that larger scale regional processes are masking any impacts of the nourishment activity on intertidal assemblages. Overall, potential effects are considered to be neutral.	**N**	No mitigation required – but actions recomm-ended in Section 6.4.4
	Continuing the annual programme of beach nourishment will sustain the present level of flood risk in the short term within the tidal floodplain. This will benefit freshwater and terrestrial habitats and associated species, some of which may be of conservation concern and which may contribute to the ecological value of the Coastal Country Park. It also provides protection to the dune habitats along the frontage, which in turn protect important species such as *Salicornia*, sea buckthorn and associated species such as nesting birds.	**+** *Perm, Rev, Local-Reg, ST*	None required
	Continuing beach nourishment will result in increasing requirements for dredging of offshore sandbanks to source sand for nourishment activities, with associated adverse impacts on the biodiversity of these areas. In the short term, these impacts have already been assessed for the licensed sources proposed to be used, and so this is considered to be neutral.	**N**	None required
6.4	Assessments of the preceding decades of beach nourishment have concluded that the sand eroded from the beaches along the coastal frontage is likely to be transported downdrift and offshore; with some likely accretion in the areas downdrift at Gibraltar Point and potentially, in The Wash. However, as described for the designated sites and discussed under sub-objective 3.4, there is no proven linkage for indirect effects on fisheries and shellfisheries along the coastal frontage and downdrift into The Wash as a consequence of the continuation of the present annual beach nourishment regime. The annual environmental monitoring programme (Environment Agency, 2018) includes consideration of the potential impacts on the brown shrimp fishery. This idenitified that no impacts of nourishment activity on epifaunal communities (brown shrimp) were recorded for 2017, nor were any longer term trends apparent. In addition, assessments of cockle stock estimates provided by the local IFCA found no relationship between cockle stocks and the intensity of nourishment activity. No changes to this conclusion are anticipated in the short term. However, given the residual uncertainty, the continuation of the present monitoring programme is recommended to monitor any future changes in water quality and fish yields. Some modelling of potential geomorphological changes and associated effects on fisheries during and post strategy implementation is also required. Overall, potential effects are considered to be neutral.	**N**	Actions recommend-ed in Section 6.4.4
6.5	Aside from the benefits to habitats and species within the tidal floodplain in terms of sustaining the present level of flood protection afforded to coastal habitats (sub-objective 6.3), opportunities for habitat restoration or creation	**N**	Actions recommend-

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	directly as a result of the strategy proposals are limited in the short term. Specific and ongoing opportunities include the planting of marram grass to establish pioneer dunes along the beach. Overall, potential effects are considered to be neutral. Given the value of the strategy area and adjoining areas, more significant opportunities should be considered in consultation with environmental stakeholders during the future implementation of the strategy.		ed in Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
6.1	As described in the short term, the HRA has identified that the proposed programme of annual beach nourishment works in the medium and/or long term would have no direct or indirect effects on the following European/international designated sites and their underpinning SSSIs and NNRs, given the distance from the strategy area and/or the lack of a potential direct impact pathway: • The Humber estuary (SPA, SAC, Ramsar) to the north of Zone A (all features) • The North Norfolk Coast (SPA, Ramsar, part of The Wash and North Norfolk Coast SAC) to the south east of Zone C (all features) • The Greater Wash SPA in the near and offshore waters (all features) • The Inner Dowsing, Race Bank and North Ridge Offshore SAC (sandbanks) • Gibraltar Point Ramsar site (invertebrates) • The Wash and North Norfolk Coast SAC (otter, seals) Overall, potential effects are considered to be neutral.	**N**	None required
	The initial screening assessment undertaken as part of the HRA (Appendix A) concluded that there could be likely significant effects on some of the habitats and species of the following sites (affected features in brackets) as a result of scenario 1 in the medium and/or long term: • Gibraltar Point SPA and Ramsar site (all qualifying bird species) • The Wash and North Norfolk Coast SAC (Mediterranean and thermo-Atlantic halophilous scrubs, Samphire *Salicornia* and other annuals colonising mud and sand) • The Wash SPA and Ramsar sites (all qualifying bird species) • Inner Dowsing, Race Bank and North Ridge Offshore SAC (*Sabellaria* reefs) However, the AA (Appendix A) concluded that no adverse effects are anticipated on these features (and their qualifying features) within the potential zone of influence of the strategy proposals alone in the medium or long term; although further detailed consideration of potential effects will be required as the strategy is developed. These potential effects will need to be considered in the context of the existing baseline of qualifying features and taking into account how rising	**X/?** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	sea levels and increase in frequency of storm events in the medium to long term.		
	As described in the short term, the HRA (Stage 2 AA) (Appendix A) concluded that there is potential for indirect **uncertain** effects on the following European/international sites and their underpinning SSSI/NNR designations downdrift of the nourished area as a consequence of the continuation of the present annual beach nourishment regime alone in the medium and/or long term: • Saltfeetby-Theddlethorpe Dunes and Gibraltar Point SAC (dune habitats at Gibraltar Point) • Gibraltar Point Ramsar site (dune and saltmarsh habitats) • The Wash and North Norfolk Coast SAC (mudflats and sandflats not covered by seawater at low tide, sandbanks and reefs) The Stage 2 AA also identified the potential for **uncertain** in-combination impacts on the following sites in the medium to long-term: • Inner Dowsing, Race Bank and North Ridge Offshore SAC (*Sabellaria* reefs) – in combination with the Triton Knoll project only • The Wash SPA and Ramsar sites (all qualifying bird species) – in combination with The Wash SMP • The Wash and North Norfolk Coast SAC (sandflats; pioneer vegetation on mud; halophilous scrub) – in combination with The Wash SMP These potential effects will need to be considered in the context of the existing baseline of qualifying features and taking into account how rising sea levels and increase in frequency of storm events in the medium to long term.	**X/?** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4 and Appropriate Assessment (Stage 2)
	As described in the short term, the annual programme of beach nourishment, supplemented with an increase in the landward sea defences in the long term, will continue to sustain the present level of flood protection in the medium to long term to designated sites within the tidal floodplain. This will benefit freshwater and terrestrial features that would be adversely affected by saline incursion.	**++** *Perm, Rev, Reg, MT to LT*	None required
6.2	As described in the short term, the annual programme of beach nourishment will continue to sustain the present level of flood protection to non-designated sites within the tidal floodplain in the medium to long term – with significant benefits to freshwater and terrestrial habitats (including LWS and SNCI) (see Table 3.2 for details).	**+** *Perm, Rev, Reg, MT to LT*	None required
	As described in the short term, there is potential for direct impacts on non-statutory sites of conservation value (LWS and SNCI) along the coastal frontage, as a result of continued beach nourishment activities and access in the medium to long term. However, no adverse impacts have occurred in the preceding decades of beach nourishment – and any measures already in place to protect these sites can continue to be implemented. In the medium to long term, the presence of a higher and wider beach along the frontage over time will continue to provide additional erosion protection and benefits to the existing and pioneer sand dunes along the coast, and associated species, many of which are locally designated.	**N**	Mitigation not required but actions recommen-ded in Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	There is potential for direct impacts on locally designated sand dune habitats along the coast should any increases in the landward sea defences be required to support the fronting beach.	**X** *Perm, Rev, Local, LT*	Yes – see Section 6.4.4
6.3	As described in the short term, there is potential for direct impacts on coastal and marine species of conservation concern (e.g. *Sabellaria spinulosa*) – where present along the coastal frontage/in nearshore waters outside the boundary of the marine SAC – as a result of beach nourishment activities and access. The intertidal and subtidal habitats and features for which the Lincs Belt recommended MCZ was considered for designation (but not designated) in Zones A and B have the potential to continue to be directly and/or indirectly affected by the beach nourishment activities in the medium to long term. However, no adverse impacts have occurred in the preceding decades of beach nourishment – and any measures already in place to protect these habitats and species can continue to be implemented (e.g. appropriate placement of the sinker line that conveys the dredged sand from the dredger to the beach).	**X** *Perm, Rev, Local, LT*	Actions recommen-ded in Section 6.4.4
	As described in the short term, continuing beach nourishment will have direct impacts on the intertidal and subtidal habitats and associated invertebrate communities – with continued disturbance and increasing volumes of nourishment material on an annual basis in the medium to long term. The long term data from the annual environmental monitoring indicates that the invertebrate communities have generally been very variable over time and such variability is typical of mobile sandy habitats. As such, there is likely to be minimal impacts as a result of the annual beach nourishment.	**N**	No mitigation required – but actions recommen-ded in Section 6.4.4
	The annual programme of beach nourishment will continue to sustain the present level of flood protection in the medium to long term within the tidal floodplain. This would benefit freshwater and terrestrial habitats and associated species, some of which may be of conservation concern, within the wider floodplain.	**+** *Perm, Rev, Reg, MT to LT*	None required
	Continuing beach nourishment will result in increasing requirements for dredging of offshore sandbanks to source sand for nourishment activities (refer to sub-objective 4.2 for details), with associated adverse impacts on the biodiversity of these areas. However, in the medium to long term, new sources are likely to be required to provide the increasing demand for material to sustain beach levels with potential for impacts on the habitats and species of previously undisturbed offshore areas (sandbanks) of ecological value.	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4
6.4	As described in the short term and discussed under sub-objective 3.4, there is potential for indirect effects on fisheries and shellfisheries along the coastal frontage and downdrift into The Wash as a consequence of the continuation of the present annual beach nourishment regime in the medium to long term. Whilst data from environmental monitoring and stakeholder data indicates that there is no proven linkage for indirect effects on fisheries and shellfisheries along the coastal frontage and	**X/?** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	downdrift into The Wash, there remains some uncertainty with the likely increasing volume of material 'lost' downdrift and residual potential for impacts. Given this residual uncertainty, the continuation of the present monitoring programme, including a review of water quality and fish yields, is recommended to monitor any future changes. Some modelling of potential geomorphological changes and associated effects on fisheries during and post strategy implementation is also required.		
6.5	Aside from the benefits to habitats and species within the tidal floodplain in terms of flood protection, opportunities for habitat restoration or creation directly as a result of the scheme proposals are limited in the medium to long term. Given the value of the strategy area and adjoining areas, more significant opportunities that could be delivered in the medium to long term should be considered in consultation with environmental stakeholders.	**N**	Yes – see Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signif-cance**	**Mitigation/ actions**
6.1	The HRA has identified that the installation of new rock structures and associated supplementary beach nourishment in the medium to long term would have no direct or indirect effects on the following European/international designated sites and their underpinning SSSIs and NNRs, given the distance from the strategy area and/or the lack of a potential direct impact pathway: • The Humber estuary (SPA, SAC, Ramsar) to the north of Zone A (all features) • The North Norfolk Coast (SPA, Ramsar, part of The Wash and North Norfolk Coast SAC) to the south east of Zone C (all features) • The Greater Wash SPA in the near and offshore waters (all features) • The Inner Dowsing, Race Bank and North Ridge Offshore SAC (sandbanks) • Gibraltar Point Ramsar site (invertebrates) • The Wash and North Norfolk Coast SAC (otter, seals)	**N**	None required
	The HRA (Stage 2 AA) concluded that there is potential for **uncertain** effects on the following European/international sites and their underpinning SSSI/NNR designations downdrift of new structures as a result of the medium to long-term scenario 2 proposals (alone). • Saltfeetby-Theddlethorpe Dunes and Gibraltar Point SAC (dune habitats at Gibraltar Point) • Gibraltar Point Ramsar site (dune and saltmarsh habitats) • Gibraltar Point SPA and Ramsar site (all qualifying bird species) • The Wash and North Norfolk Coast SAC (mudflats and sandflats not covered by seawater at low tide, sandbanks slightly covered by seawater all the time and reefs) • The Wash SPA and Ramsar sites (qualifying non-breeding bird species) • Inner Dowsing, Race Bank and North Ridge Offshore SAC (*Sabellaria* reefs)	**X/?** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4 and Appropriate Assessment

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signif-cance**	**Mitigation/ actions**
	There is potential for **uncertain** in-combination impacts on the following sites in the medium to long-term: • Inner Dowsing, Race Bank and North Ridge Offshore SAC (*Sabellaria* reefs) – in combination with the Triton Knoll project • The Wash SPA and Ramsar site (qualifying non-breeding bird species) – in combination with The Wash SMP • The Wash and North Norfolk Coast SAC (sandflats; pioneer vegetation on mud; halophilous scrub) – in combination with The Wash SMP The new rock structures will trap sediment between the structures, significantly reducing longshore drift and leading to depletion of beaches and habitats downdrift. This effect will be most pronounced if fishtail structures are installed, creating new bays along the frontage. This would be a significant change to the present situation, with a reduction in the volume of material 'lost' from the frontage with resulting changes to the habitats downdrift. Further assessment, testing and monitoring will be required prior to the introduction of any new structures to consider any predicted changes and how this may affect areas downdrift.		
	Scenario 2 will continue to sustain the present level of flood protection in the medium to long term to designated sites within the tidal floodplain, with benefits to freshwater and terrestrial features that would be adversely affected by saline incursion.	**++** *Perm, Rev, Reg, MT to LT*	None required
6.2	Scenario 2 will continue to sustain the present level of flood protection to non-designated sites within the tidal floodplain in the medium to long term – with significant benefits to freshwater and terrestrial habitats (including LWS and SNCI) (see Table 3.2).	**++** *Perm, Rev, Reg, MT to LT*	None required
	Direct impacts as a result of the presence/footprint of new large structures and changes in beach levels/widths on non-statutory sites of conservation value (LWS and SNCI) located along the coastal frontage in the medium to long term. Potential additional impacts from the associated supplementary beach nourishment activities. The nature, type and significance of impacts will depend on the sensitivity and value of affected locations and the design of proposed structures and further assessment will be required. There is also potential for direct impacts on locally designated sand dune habitats along the coast should any increases in the landward sea defences that support the fronting beach be required – including potentially increased access and maintenance activities during future operation.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.4.4
	The presence of the rock structures and beach along the frontage over time will continue to provide additional erosion protection and benefits to the sand dunes along the coast, many of which are locally designated.	**+** *Perm, Rev, Local, MT to LT*	None required
6.3	Direct impacts as a result of the presence/footprint of new large structures and changes in beach levels/widths on coastal and marine species of conservation concern (e.g. *Sabellaria spinulosa*) – where present along the coastal frontage/in nearshore waters outside the boundary of the marine	**X** *Perm, Rev,*	Yes – see Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signif-cance**	**Mitigation/ actions**
	SAC. Potential additional impacts from the associated supplementary beach nourishment activities and any activities in the long term in Zones A and C. Direct impacts as a result of the presence/footprint of new large structures and changes in beach levels/widths, on the intertidal and subtidal habitats and features for which the Lincs Belt recommended MCZ was considered for classification (but not classified) in Zones A and B. Potential impacts from the associated supplementary beach nourishment activities and any activities in the long term in Zones A and C.	*Reg, MT to LT*	
	The introduction of structures and associated beach nourishment will have direct impacts on the intertidal and subtidal habitats and associated invertebrate communities – with continued disturbance and increasing volumes of nourishment material on an annual basis in the medium to long term. As described for scenario 1, the long term data from the annual environmental monitoring indicates that the invertebrate communities have generally been very variable over time and such variability is typical of mobile sandy habitats. Therefore, whilst some losses and changes are anticipated, any predicted effects are not expected to be significant.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.4.4
	Scenario 2 will continue to sustain the present level of flood protection in the medium to long term within the tidal floodplain. This would benefit freshwater and terrestrial habitats and associated species, some of which may be of conservation concern, within the wider floodplain and directly protect habitats and species along the frontage.	**+** *Perm, Rev, Reg, MT to LT*	None required
	Although the volume is significantly reduced compared to scenario 1, there remains a need for supplementary beach nourishment which will require continued dredging of offshore sandbanks to source sand for nourishment activities, with associated adverse impacts on the biodiversity of these areas. In the medium to long term, new sources may be required to provide the increasing demand for material to sustain beach levels and we can only assume at this stage that new dredging area licences will be obtained.	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4
6.4	The installation of new structures, together with supplementary beach nourishment, has potential for indirect effects on fisheries and shellfisheries along the coastal frontage and downdrift into The Wash in the medium to long term. Whilst data from environmental monitoring and stakeholder data indicates that there is no proven linkage for indirect effects on fisheries and shellfisheries along the coastal frontage and downdrift into The Wash, there remains some uncertainty with the increasing volume of material 'lost' downdrift and residual potential for impacts. Given this residual uncertainty, the continuation of the present monitoring programme, including a review of water quality data and fish yields, is recommended to monitor any future changes. Some modelling of potential geomorphological changes and associated effects on fisheries during and post strategy implementation is also required. There is also potential for uncertain mixed effects on fisheries in terms of localised habitat, sediment, chemical and physical process changes resulting from the introduction of structures. Further assessment and consideration will be required dring the development of the structures.	**X/?** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.4.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signif-cance**	**Mitigation/ actions**
6.5	Aside from the benefits to habitats and species within the tidal floodplain in terms of flood protection, opportunities for habitat restoration or creation directly as a result of the scheme proposals are limited in the medium to long term. Given the value of the strategy area and adjoining areas, more significant opportunities that could be delivered in the medium to long term should be considered in consultation with environmental stakeholders.	**N**	Yes – see Section 6.4.4
	Potential for biodiversity enhancement through the provision of new rock habitat. Further opportunity for new rock structures to be designed to optimise the provision of new habitat for colonisation by marine invertebrates.	**+** *Perm, Rev, Local, MT to LT*	Actions recommen-ded in Section 6.4.4

6.4.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on biodiversity predicted during the future implementation of the strategy proposals and described in Section 6.4.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Sub-objective 6.1: designated sites

Both scenarios/proposals in the short, medium and long term.

The Appropriate Assessment (HRA Stage 2) identified some uncertain impacts (alone and/or in combination) on some European and international conservation sites in the medium and long-term (see Section 6.4.3), which will require appropriate mitigation and monitoring to avoid adverse effects on integrity of the sites.

In the short term, the present physical and environmental monitoring regime undertaken for the LBM project will be continued, to monitor the effects of the ongoing and proposed programme of annual beach nourishment and provide a continuous historical baseline dataset. The scope and results of this monitoring programme will continue to be reviewed annually through the submission of an Annual Report to the MMO (this is a condition of the current marine licence) and consultation with statutory bodies (e.g. Natural England, Eastern IFCA, CEFAS) and key stakeholders (e.g. LWT). This annual monitoring programme (details of which are included in the Annual Monitoring Report) comprises:

- Annual beach profile monitoring (undertaken each year to identify where beach levels have reduced and require nourishment and provides valuable data regarding shoreline dynamics).
- Environmental monitoring:
    - particle size analysis assessing the range, size and distribution of sediments and their associated physical and chemical properties.
    - marine benthic invertebrates e.g. intertidal invertebrates living within beach sediments and subtidal epifaunal invertebrates.
- Review of available fish/shellfish data: cockle stock estimates.

Potential changes to this monitoring regime may also be required for the proposed annual beach nourishment works in the short term. These may arise from project level HRA and assent

from Natural England and any new conditions imposed by the MMO for the future marine licence; the scope of which cannot yet be identified.

In the medium and long term, the mitigation and modelling (computational, physical and environmental) required will depend on what decisions are made regarding climate change adaptation in the face of sea level rise and a policy of hold the line. However, assuming the current baseline of designated site boundaries and distribution of features, the supply of beach sediment reaching Gibraltar Point and other sites downdrift of the nourishment areas will reduce due to sea level rise (scenarios 1 and 2) and more material remaining *in situ* due to the introduction of structures and reduced frequency of nourishment (scenario 2). If the reduced supply contributes to erosion and/or insufficient material to maintain littoral habitats then mechanisms for either introducing more sediment or some form of managed realignment may be required. Monitoring will be necessary to inform what interventions are necessary, in particular what changes occur at the ness at the northern end of Gibraltar Point; how it is indirectly leading to erosion of saltmarsh and dune habitat through migration of Greenshank Creek and other channels; and whether it continues to migrate southwards.

A Strategic Monitoring and Mitigation Action Plan will be required, prior to strategy implementation, building on the existing LBM monitoring regime, to identify the actions needed to avoid/manage any uncertain effects that could be attributable to the implementation of the strategy either alone or in combination with other plans and projects. This Action Plan will be developed and then implemented at the outset of the strategy implementation (i.e. whilst the short-term proposals are being implemented and prior to any changes from the present management regime).

The scope and detail of this Plan will be developed and agreed with Natural England and other key statutory bodies and stakeholders (e.g. Eastern IFCA, CEFAS, LWT). This Plan will include a process for review and appropriate intervention and/or design changes (e.g. refinements to sediment sampling strategies, implementation of alternative and possibly 'softer' design approaches and variations in the standard of protection provided) if required. Triggers or an early warning system will be agreed with Natural England to instigate change if levels are reached that require action. These triggers will be regularly reviewed (and updated if needed) through an iterative approach in response to the analysis of ongoing monitoring and observed changes. The Plan will outline existing available data, ongoing and future monitoring required to understand coastal change, together with monitoring frequency, timescales and responsibility, triggers for change and recommendations. It should be recognised that it will take time to build datasets from new monitoring that enable long-term trends and changes to be identified.

Key components of, and recommendations within this Plan (for both/either scenario) are detailed further in the HRA (Stage 2) – see Appendix A.

Any works arising from the strategy will also be subject to project level EIA including WFD assessment, HRA assent from Natural England to support future marine licences from the MMO, or planning consents from ELDC. In addition, any reviews of the strategy itself will also be subject to strategic-level HRA requiring approval from Natural England. It is acknowledged that implementation of any proposed works arising from the strategy implementation will not be possible without these approvals.

The project level HRA(s) will more precisely describe the potential effects of any works proposed (for both scenarios) in the medium and long-term, given our improved knowledge resulting from the monitoring and modelling work undertaken to inform the technical feasibility of options. The HRA will also describe the project level mitigation measures (e.g. appropriate timing of any works to avoid periods of key bird usage in identified locations), when specific details of the location, scale and nature of any upgrading works are known. The scheme level HRA(s) will consider the in-combination effects with the Triton Knoll project (unless already fully

constructed) and The Wash SMP2, plus any additional projects/plans that are relevant at the time of preparation.

Sub-objective 6.2: non-designated sites

Continuing present management/beach nourishment (in the short, medium and long term):

- Continue to implement protective measures for non-designated sites currently in place for beach nourishment activities in the short, medium and long term[26]. Consultation and liaison will be required with LWT and other key stakeholders to consider potential impacts and agree potential mitigation.This could include the fencing of working areas, use of appropriate land-based plant to minimise noise disturbance and the avoidance of sensitive areas and working periods.
- In the long term, management of impacts on habitats and species within non-designated sites within the zone of influence of works to raise/widen landward sea defences and any additional works. Assessment and surveys will be required to consider potential impacts, seek to avoid impacts through appropriate design and construction, and identifiy any mitigation measures required. Consultation and liaison will be required with LWT and other key stakeholders.

Introducing new rock structures (in the medium to long term):

- In addition to the measures recommended for scenario 1, management of impacts on habitats and species within non-designated sites within the zone of influence of the new rock structures will be required, although the recommended mitigation measures will be as described for scenario 1 e.g. survey, assessment, consultation and identification of mitigation measures.

Sub-objective 6.3: coastal and marine habitats and species of conservation concern

Continuing present management/beach nourishment (in the short, medium and long term):

- Continue to implement protective measures currently in place for beach nourishment activities (see above) in the short, medium and long term e.g. the avoidance of areas of *Sabellaria*; minimising footprint of works/sinker line. Undertake surveys, as required, and consult with statutory authorities such as Natural England and the MMO.
- Consider the impacts on offshore sandbanks in the long term through the licensing process (or alternative at that time) in consultation with relevant authorities – including, as required, surveys and assessments.
- Continued annual monitoring of benthic invertebrate communities and data review to help understand the ecology of the inshore waters (see Section 6.13).

Introducing new rock structures (in the medium to long term):

- In addition to the measures described for scenario 1, in planning the siting, dimensions and location of new rock structures, consideration should be given to the locations selected, minimising the overall land take and minimising the loss of beach, interidal and subtidal habitat. The specific measures required will vary by location, depending on the specific habitats present and their sensitivity to change.

Sub-objective 6.4: fisheries and shellfisheries

Continuing present management/beach nourishment (in the short, medium and long term):

[26] Described in Environment Agency (2016b) Lincshore 2016-2020 Environmental Statement.

- Continue to implement measures currently in place for beach nourishment activities in the short, medium and long term. Under the terms of the present marine licence (2016-2020) for the Lincshore beach nourishment scheme, there are a range of conditions relating to the management of potential impacts on fisheries, both within and outside the strategy area (see Section 6.2.4).
- As described above for the HRA and Sections 6.2.4 and 6.5.4, undertake further assessment of potential sediment movement and any geomorphological changes to consider/manage potential downdrift effects on fisheries and shellfisheries.
- Continued annual monitoring of epifaunal species to help understand the population dynamics of the inshore waters and associated fishery (see Section 6.13).

Introducing new rock structures (in the medium to long term):

- In addition to the measures described for scenario 1, consideration should be given to the locations selected, minimising the overall land take and minimising the loss of beach, intertidal and subtidal habitat that provide existing habitat for shellfish/fish species. Design should be informed by existing data regarding the ecological value of affected areas, supplemented by additional surveys and measures agreed in consultation with statutory bodies such as Natural England, the MMO and Eastern IFCA/CEFAS.
- The design of the rock structures should be optimised through, for example, material choice and appropriate positioning, to provide additional habitats and maximise opportunities for biodiversity enhancement, including the provision of nursery areas for fisheries. Proposals should draw from successful experiences elsewhere in the UK (e.g. Naylor *et al*, 2018[27]) and be developed in consutation with statutory bodies and key stakeholders.

Sub-objective 6.5: biodiversity enhancement

More significant opportunities for biodiversity enhancement within the strategy area should be sought in consultation with stakeholders. Limited specific opportunities have been identified to date by stakeholders (see Section 2.8), but discussions should be continued and additional opportunities sought during the future implementation of the strategy proposals.

Specifially, the strategy should:

- Continue to promote dune establishment along the frontage through planting of marram grass on the nourished beaches in consultation with local stakeholders; and
- As discussed above, any new rock structures should be designed/include features to provide additional habitat for marine invertebrates/fish and enhance biodiversity directly or indirectly (by providing additional prey species) within the coastal waters.

6.5 Soils, geology and geomorphology (Objectives 7 and 8)

6.5.1 Objectives

Objective 7: Protect geological diversity and work with natural geomorphological processes
Objective 8: Minimise risk to sites with pollution potential

[27] Naylor, MacArthur, Hampshire et al. (2018) Rock armour for birds and their prey: ecological enhancement of coastal engineering. Proceedings of the Institution of Civil Engineers. Maritime Engineering 170 June 2017 Issue MA2. Pages 67–82.

6.5.2 Receptors considered

	Sub-topic	Receptors/opportunities scoped in
7	Designated earth heritage sites	• Designated earth heritage sites (geological SSSI, RIGS and LGS) within the strategy area at risk from flooding or potentially affected by flood risk management actions e.g. erosion, direct impacts.
	Geomorphology and sediment	• Geomorphology and the sediment system within the strategy area and downdrift into The Wash, that could be affected by flood risk management actions.
8	Contaminated land	• Areas of known contaminated land or licensed landfill sites within the strategy area at risk from flooding or potentially affected by flood risk management actions.

6.5.3 Assessment of potential effects

6.5.3.1 Geological diversity and processes (Objective 7)

Ref	Sub-objectives	Assessment criteria
7.1	• Avoid damage to/loss of, and where possible enhance, nationally and locally designated sites of earth heritage interest	• *Do the proposals affect geological interests of nationally (SSSI) or locally (LGS, RIGS) designated earth heritage sites, compared to the present day?*
7.2	• Work with natural geomorphological processes, wherever possible, including sediment movement	• *Do the proposals work with natural geomorphological processes, including sediment movement, and enable natural evolution of the coastline?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
7.1	The present high beach levels as a result of the previous annual beach nourishment provide protection from erosion to a range of deposits such as the intertidal sediments, fossil saltmarsh, forest features and peat and clay exposures along the coastal frontage – including areas designated within the Chapel Point to Wolla Bank geological SSSI and the Regionally Important Geological Sites (RIGS) (the foreshores at Huttoft Bank, Sutton on Sea, Vickers Point and Wolla Bank) (Figures G.2 and G.3). These exposures of post-glacial deposits along the coastline are at present wholly or partially covered with beach nourishment material. The deposits exposed at any one time are a function of the shifting ridge and runnel system operating on the lower beach. The proposals would continue to provide a cover of sand and sediment overlying the deposits that would continue to protect these features from erosion in the short term. Depending on the location and erosion risk, the degree of coverage will vary with beach levels.	**++** *Perm, Rev, Reg, ST*	No mitigation required – but actions recommen-ded in Section 6.5.4
7.2	Beaches are recognised as providing the most effective form of coastal defence; they are a natural buffer between the land and sea and are efficient dissipaters of wave energy, but only if they are of sufficient width and level.	**N**	Yes – see Section 6.5.4

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	The proposals for continued beach nourishment in the short term would maintain the present artificial 'holding' of the coastline with a hard line of coastal defences and an artificially nourished beach. There is, however, virtually no contemporary natural feed of sediment onto the beaches along this frontage and without nourishment the foreshore would return to a depleted state. This would ultimately lead to a high level of overtopping, undermining of defences, their subsequent failure and catastrophic flooding. Sediment along this coastline moves by a combination of alongshore and cross-shore movement in a net southwards direction, driven by dominant north-easterly waves and by southward flood residual currents. Analysis undertaken for the strategy (CH2M, 2017) has identified that sand is then moved onshore through the landward migration of ridges[28]. Whilst the placement of material on the beach has an immediate and direct impact on beach levels and sediment character, material is only temporarily retained before it is eroded and moved southwards, feeding beaches to the south. Although the nourishment will mean that there will also be more fine sediment available to the transport system, the impacts on coastal processes are negligible: the addition of nourishment material will not affect this process, it simply adds non-native sediment into the system that would not occur naturally. The grain size of the sediment placed on the beaches has the potential to affect morphology, in terms of a steeper beach face developing and mobility of sediment. The proposed nourishment sediment is of a similar grading and colour and therefore is not considered to be detrimental in terms of changing the existing morphology along local beaches (subject to control measures, see mitigation actions below). The introduction of additional sediment into the beach system through the nourishment programme to date has contributed to the growth of beaches to the south of the nourishment area. Key areas of accumulation are south of Skegness, where a ness is growing and Gibraltar Point. Although naturally conducive to accumulation of sediment due to tidal processes and interaction of the nearshore sand bars, the level of growth in both areas can be attributed to the additional sediment being added to the system through nourishment of the coastline to the north. The proposed strategy will result in continued growth of beaches south of Skegness and ultimately Gibraltar Point, sustaining and enabling development of further beach ridges. There is, however, the possibility that there could be a minor change in the composition of the beaches, particularly at Gibraltar Point, due to an increased proportion of sand compared to gravel (shingle), which may slightly alter the geomorphological response of the beaches. There is also potential for sediment from the nourishment areas to be moved offshore into the bank and channel system at the mouth of The Wash, which may cause changes in their form and position, affecting both navigation and nearshore processes, in particular tidal flows. Evidence from the nourishment campaigns which have been undertaken since 1994		

[28] Shoreline behaviour and response to inform strategy option appraisal, Strategy report Appendix K1.

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	has been unable to differentiate natural change from that caused by nourishment, but this remains an area of uncertainty. In summary, continued nourishment makes use of the natural function of beaches as natural buffers and effective dissipaters of wave energy, contributes to the natural longshore transport of sediment and has led to the development of new geomorphological features. In that way this approach can be considered to be working with natural processes. It does, however. contribute sediment to the coastal system (both locally and wider scale) which would not otherwise occur, which may have consequences for other receptors (as discussed elsewhere within this document in terms of sub-objectives 3.4, 6.1 and 6.4).		

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
7.1	As described in the short term, annual beach nourishment in the medium to long term will maintain the present high beach levels and continue to provide protection from erosion to a range of deposits such as the intertidal sediments, fossil saltmarsh, forest features and peat and clay exposures along the coastal frontage – situated within and outside designated areas. The proposals would provide a cover of sand and sediment overlying the deposits that would continue to protect these features from erosion in the medium to long term. Depending on the location and erosion risk, the degree of coverage will vary with beach levels.	**++** *Perm, Rev, Reg, MT to LT*	None required
7.2	As described in the short term, the proposals for continued beach nourishment in the medium to long term would maintain the present artificial 'holding' of the coastline with a hard line of coastal defences and an artificially nourished beach. In response to climate change and higher sea levels it is anticipated that higher and wider beaches will be required, which will involve increasing nourishment volumes to maintain the same standard of protection. The proposed strategy makes use of the natural function of beaches as natural buffers and effective dissipaters of wave energy, contributing to the natural longshore transport of sediment and leading to the development of new geomorphological features. Further accumulation of sediment and development of the ness feature south of Skegness would be anticipated in the long term, together with further growth of the spit at Gibraltar Point, both seawards and southwards. There is evidence that the ness at Skegness is currently moving southwards and may eventually contribute to the growth of Gibraltar Spit. Any works along the northern edge of the current ness would need to take account of the future erosion risk here, as the ness is likely to continue to move south. In the long term, there may be a need to raise the height of the seawall to create a higher sand backstop to the beach crest level.	**N**	Yes – see Section 6.5.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	Whilst this will reduce sand being washed or blown landwards, it will not affect the longshore transport of sediment, nor should it impact on movement across the beach. At some point in the future, there may be a need for nourishment or beach management works to extend into zones A and C, but the impacts of this have not been considered here and will require further assessments at the time, as environmental baselines may have changed by this time.		

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
7.1	The introduction of new rock structures in the medium term would provide continued protection from erosion, with maintenance of an overlying beach layer, to soils and geology, including areas designated as a geological SSSI (Chapel Point to Wolla Bank) and Regionally Important Geological Sites (RIGS) (the foreshores at Huttoft Bank, Sutton on Sea, Vickers Point and Wolla Bank) situated along the coastal frontage. These include fossil saltmarsh and forest features that are currently protected from erosion by the Lincshore beach nourishment.	**+** *Perm, Rev, Reg, MT to LT*	None required
	However, there is a risk of potential damage to these features where any new rock groyne or fishtail structures may be placed or require excavation along the foreshore. No excavation is anticipated, but the risk of damage still exists and appropriate siting of structures will be required during planning and design. As the beaches stabilise and realign in the medium to long term, in particular between fishtail structures, there is the potential for the exposure of deposits, although subsequent intermittent supplementary beach nourishment could provide protection.	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.5.4
7.2	The introduction of new rock structures in the medium term would continue to maintain the present artificial 'holding' of the coastline with a hard line of coastal defences and an artificially nourished beach. The key difference from scenario 1 is that this scenario would introduce additional permanent structures that would be intended to interrupt the natural longshore movement of sand. As for scenario 1, the concept of using a beach to provide a natural buffer and dissipater of wave energy is working with natural processes, although it involves introducing sediment to the system which would not naturally occur. The aim of the structures is to reduce the movement of nourishment sediment alongshore, thereby reducing losses and decreasing the nourishment volumes required (compared to scenario 1). The design of the structures will define how much sediment will be retained and the design stage will also need to consider impact on nearshore currents and the potential risk for sediment to be drawn down and lost	**X** *Perm, Rev, Reg, MT to LT*	Yes - see Section 6.5.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	offshore. There is a risk that downdrift areas will become deprived of sediment, at least for a period until sediment builds up sufficiently to be able to bypass structures, and this will need to be addressed through continued monitoring both along the nourished frontage and adjacent frontages. As for scenario 1, in the long term, there may be a need to raise the height of the seawall to create a higher sand backstop to the beach crest level. Whilst this will reduce sand being washed or blown landwards, it will not affect the longshore transport of sediment, nor should it impact on movement across the beach. As for scenario 1, at some point in the future, there may be a need for nourishment or beach management works to extend into Zones A and C, the impacts of this are not considered here and will require further assessments at the time, as environmental baselines may have changed by this time.		

6.5.3.2 Objective 8: Contaminated land

	Sub-objective	Assessment criteria
8.1	• Minimise the vulnerability of areas of known/potential contaminated land and landfills to tidal flooding	• *Do the proposals change the risk of flooding to known and potentially contaminated land and licensed/historic landfills, compared to the present day?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
8.1	Continuing the annual programme of beach nourishment will sustain the present level of flood protection within the tidal floodplain in the short term. This would continue to benefit soils and any potentially polluting sites (e.g. active and historic licensed landfills, local authority contaminated sites) within the wider floodplain by protecting soil quality and productivity, and minimising risks of waterborne pollution to soils and watercourses from any potentially polluting sites.	**++** *Perm, Rev, Reg, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
8.1	As described in the short term, continuing the annual programme of beach nourishment and any additional works in the long term to increase the landward sea defences, will sustain the present level of flood protection	**++**	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	within the tidal floodplain in the medium to long term. This would continue to sustain the present level of flood protection to soils and any potentially polluting sites within the wider floodplain with benefits to soil quality and productivity, minimising risks of waterborne pollution to soils and watercourses from any potentially polluting sites.	*Perm, Rev, Reg, MT to LT*	

MEDIUM TERM (6 to 35 years) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
8.1	Scenario 2 will sustain the present level of flood protection to soils and any potentially polluting sites within the tidal flood plain in the medium to long term. This would continue to benefit soil quality and productivity and minimise risks of waterborne pollution to soils and watercourses from any potentially polluting sites.	**++** *Perm, Rev, Reg, LT*	None required

6.5.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on soils, geology and geomorphology predicted during the future implementation of the strategy proposals and described in Section 6.5.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Objective 7: Geological diversity and processes

Sub-objective 7.1: designated earth heritage sites

Continuing present management/beach nourishment (in the short, medium and long term):

- Although no adverse effects are predicted in terms of the proposals for continued annual beach nourishment, it is important to ensure that the presence of designated earth heritage sites and other features of value are recognised during the planning and design of each annual nourishment operation to ensure that these features are not adversely affected. In addition, the annual beach profile monitoring could be used to determine beach levels in each location and identify any potential impacts as a result of erosion.

Introducing new rock structures in the medium and long term:

- In planning the siting, dimensions and location of new rock structures, consideration should be given to the locations selected, minimising the overall land take and minimising impacts on designated earth heritage sites and known peat deposits along the beach frontage. The specific measures required will vary by location; depending on the land uses present and their sensitivity to change.

Sub-objective 7.2: geomorphological processes

Both scenarios in the short, medium and long term:

Although both scenarios may be considered to be working with natural processes through using a beach to provide a natural buffer and dissipater of wave energy, additional sediment will be added to the system, which would not otherwise occur. The following actions are recommended to avoid and/or mitigate the potential effects of this during the future implementation of the strategy proposals.

- Retention of existing measures in place to ensure that material deposited on the beach is as close as possible to the grain size (range, size and distribution of sediments) and composition (including physical and chemical properties) of the native sediment, whilst balancing the needs to reduce mobility. This reduces the incidence of preferential transport of finer and lighter grains, and therefore aids in minimising the impacts related to over-steepened beach profiles.
- Retention of existing measures in place to minimise the release of fines during renourishment campaigns, such as ensuring the dredger discharges at high water during slack water and use of land-based plant build bunds to try to trap the sediment.
- To monitor how the nourishment material is moved around the coastal system and to manage the risk associated with potential adverse impacts on down-drift regions, it is essential that the regular monitoring of the beaches within the nourishment area and those to the north and south is continued. Particular monitoring of the Gibraltar Point SSSI complex is recommended to improve geomorphological understanding of the on-going evolution of this area, together with monitoring of the ness feature south of Skegness to consider changes in risk to this frontage as the ness continues to move south. This information will help to inform future management decisions and inform the placement of nourishment and volumes required to ensure that the beaches are neither overnourished nor undernourished. This information will also be used to inform impact on other receptors.
- Design of structures will need to consider the impact on longshore and cross-shore sediment transport, interaction with tidal currents, and potential consequences for down drift areas. Once constructed, similar monitoring to scenario 1 will be required.
- There remains some uncertainty regarding the fate of material within the nearshore zone at the mouth of The Wash and further monitoring is required here; this could include detailed sediment tracer or sediment fingerprinting studies and bathymetric monitoring of the banks.

Objective 8: contaminated land

In terms of impacts on contaminated land (objective 8), the predicted effects of the strategy proposals are positive and no strategic mitigation actions are recommended.

6.6 Land use (Objective 9)

6.6.1 Objectives

Objective 9: Support varied land uses along the coastline

6.6.2 Receptors considered

	Sub-topic	**Receptors/opportunities scoped in**
9	Land use	Principal land uses (notably agricultural land) within the strategy area at risk from flooding or potentially affected by flood risk management actions (Figure G.5).

	Sub-topic	Receptors/opportunities scoped in
		(Properties and caravan parks are considered under the 'Population, health and local economy' receptor heading).

6.6.3 Assessment of potential effects

	Sub-objectives	Assessment criteria
9.1	• Manage risk to agricultural land, in particular that of highest quality, from tidal flooding	• *Will the proposals change risk of tidal flooding to the existing agricultural land, compared to the present day, affecting its quality and versatility?*
9.2	• Manage risk to other key land uses from tidal flooding	• *Do the proposals impact on other key land uses?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
9.1	The proposed annual beach nourishment in the short term will continue to sustain the present level of flood protection (to a 0.5% AEP, sustained in line with predicted sea level rise) to agricultural land at risk from tidal flooding. 21,000 ha of Grade 2/3 agricultural land within the floodplain will benefit; maintaining its quality and productivity and significant contribution to the local economy.	**++** *Perm, Rev, Reg, ST*	None required
9.2	Sustaining the present level of flood protection will also protect the habitability and use of urban areas landward of the sea defences – the other significant land use within the tidal floodplain. There will be no permanent changes in land use within the strategy area as the nourishment activities will be primarily confined to the beach frontage, in areas previously disturbed by beach nourishment activities.	**++** *Perm, Rev, Reg, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
9.1	As described in the short term, the proposals will continue to sustain the present level of flood protection to 21,000 ha of Grade 2/3 agricultural land within the tidal floodplain, maintaining its quality and productivity in the medium to long term.	**++** *Perm, Rev, Reg, MT to LT*	None required
9.2	As described in the short term, the proposals will continue to sustain the present level of flood protection to all land uses within the tidal floodplain, maintaining the habitability and use of urban areas in the medium to long term.	**++** *Perm, Rev, Reg, MT to LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	In the long term, there may be an increase in land take in areas where the landward sea walls need to be raised and widened to sustain the standard of flood protection in line with sea level rise. This may impact on adjacent land uses, seaward and landward of the existing defence alignment, the effects of which will be specific to each location.	**X** *Perm, IRev, Local, MT to LT*	Yes – see Section 6.6.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
9.1	The introduction of new rock structures in the medium term will continue to sustain the present level of flood protection to 21,000 ha of Grade 2/3 agricultural land within the tidal floodplain, maintaining its quality and productivity in the medium to long term.	**++** *Perm, Rev, Reg, MT to LT*	None required
9.2	The introduction of new rock structures in the medium term, the proposals will continue to sustain the present level of flood protection to all land uses within the tidal floodplain, maintaining the habitability and use of urban areas in the medium to long term.	**++** *Perm, Rev, Reg, MT to LT*	None required
	There will be a permanent loss of beach under the footprint of the new structures (between 10,000 and 12,000 m^2 for each of the potential fishtail structures), the extent of which will depend on the numbers and dimensions of structures installed. In the long term, there may be an increase in land take in areas where the landward seawalls need to be raised and widened to sustain the standard of flood protection in line with sea level rise which may impact on adjacent land uses; for example, promenade, roads, amenity spaces – specific to each affected location.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.6.4

6.6.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on land use predicted during the future implementation of the strategy proposals described in Section 6.6.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Sub-objective 9.1: Agricultural land

In terms of impacts on agricultural land, the predicted effects of the strategy proposals are positive and no strategic mitigation actions are recommended.

Sub-objective 9.2: Key land uses

Both scenarios/proposals in the medium and long term:

- In planning the siting, dimensions and location of new rock structures and any raising or widening of the landward sea defences, consideration should be given to

minimising the overall land take and minimising impacts on existing land uses along the beach frontage. The specific measures required will vary by location; depending on the land uses present and their sensitivity to change.

6.7 Water and hydromorphology (Objective 10)

6.7.1 Objectives

Objective 10: Maintain, and where possible improve, the quality of water resources as defined by the WFD

6.7.2 Receptors considered

	Sub-topic	**Receptors/opportunities scoped in**
10	Surface water and groundwater quality	• WFD waterbodies (coastal (2), river (12) and groundwater (1) and associated Protected Areas (e.g. Bathing Water Directive, Shellfish Directive) within the strategy area potentially affected by flood risk management actions (Figure G.6) – compliance with objectives to maintain/achieve good ecological status/potential and delivery of morphological mitigation measures, to include consideration of all relevant biological, chemical and supporting elements.

6.7.3 Assessment of potential effects

	Sub-objectives	**Assessment criteria**
10.1	Protect the quality of surface waters and groundwater and support the delivery of WFD objectives and requirements for classified water bodies and Protected Areas	• *Will the proposals help or conflict with meeting WFD objectives for good ecological status/potential for water bodies (coastal, river and groundwater) within the strategy area?* • *Will the proposals affect or contribute to the delivery of morphological mitigation measures for water bodies (coastal, transitional, river and groundwater) within the strategy area?* • *Will the proposals affect WFD protected areas, e.g. Bathing Water Directive, for water bodies within the strategy area?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
10.1	A separate assessment of compliance of the proposed strategy with the WFD has been undertaken (refer to Appendix B): a summary of conclusions is presented here. The proposal would maintain the present artificial 'holding' of the coastline with a hard line of coastal defences and an artificially nourished beach; the artificial state is already recognised in the Lincolnshire water body and adjacent river water bodies, although The Wash water bodies are currently not designated artificial or heavily modified. The strategy will involve introduction of sediment, with associated changes in shoreline erosion/accretion patterns, due to increased volumes of sediment	**N**	No mitigation required – but actions recommen-ded in Section 6.7.4

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	available for transport. Through providing a wider beach the strategy will continue to reduce risk of erosion and flooding and will help prevent the loss of beach habitat that would otherwise occur. There is potential that the movement of nourishment material southwards could have a wider scale impact on nearshore banks and channel within the Wash, which in turn could affect the flow of water in these areas; however, the natural influx of sediment is much larger than the potential input of suspended sediments that could be released from the nourishment works. There is potential for an increase in turbidity and suspended sediment concentrations due to the outwashing of fines from the recharge material, although impacts on light and water quality along the coastal frontage and within the coastal waters are however unlikely to be permanent following recharge campaigns, particularly since natural background levels of suspended sediment are high. There could however be a wider impact on phytoplankton growth, macrophytes and invertebrates, and other aquatic flora as sediment is moved offshore and alongshore; although turbidity concentrations are already high under normal conditions. No change in WFD status/potential is anticipated and the proposals will not result in a deterioration of current surface water ecological status or potential. For freshwater, groundwater and lake water bodies, the key impact will be the continued protection from saline inundation during high water events. No change in WFD status/potential is anticipated. Although there is limited scope under the strategy to address the majority of mitigation measures identified for the river water bodies, modification to the structures will be considered during scheme design and scheme level WFD assessments to reduce fish entrainment and incorporate measures for fish passage where possible. This could lead to an improvement in water body status. In terms of Protected Areas within the study area, the proposed strategy will not compromise the achievement of the WFD objectives. The strategy will prevent saline flooding of groundwater inland used for drinking water and the short-term proposals will not adversely affect the integrity of any European sites.		

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
10.1	As for the short term, the proposals would maintain the present artificial 'holding' of the coastline with a hard line of rearward coastal defences and an artificially nourished beach. The strategy will involve the introduction of increasing volumes of sediment, with associated changes in shoreline erosion/accretion patterns due to increased volumes of sediment available for transport. Through continuing to provide a wide beach, the strategy will continue to manage the risk of erosion and flooding and will help prevent the loss of beach habitat that would otherwise occur. Associated with this, there will be continued protection from	**N**	No mitigation required – but actions recommen-ded in Section 6.7.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	saline inundation during high water events for river, lake and groundwater water bodies. No change in WFD status/potential is anticipated. There is potential that the movement of nourishment material southwards could have a wider scale impact on nearshore banks and channel within the Wash, which in turn could affect the flow of water in these areas, but natural influx of sediment is much larger than the potential input of suspended sediments that could be released from the nourishment works. There is potential for an increase in turbidity and suspended sediment concentrations due to the outwashing of fines from the recharge material; however, impacts on light and water quality along the coastal frontage and within the coastal waters are unlikely to be permanent following nourishment campaigns. There could however be a wider impact on phytoplankton growth, macrophytes and invertebrates and other aquatic flora as sediment is moved offshore and alongshore, although turbidity concentrations are already high under normal conditions. No change in WFD status/potential is anticipated and the proposals will not result in a deterioration of current surface water ecological status or potential. In terms of Protected Areas within the study area, the proposed strategy will not compromise the achievement of the WFD objectives, although further monitoring and modelling is proposed to better understand coastal change resulting from the proposed medium and long-term strategy proposals. The strategy will prevent saline flooding of groundwater inland used for drinking water. With the implementation of mitigation and monitoring (together with flexibility in the design of future medium and long-term schemes), the strategy will not adversely affect the integrity of any European sites.		

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
10.1	The proposals would maintain the present artificial 'holding' of the coastline with a hard line of rearward coastal defences, an artificially nourished beach and a series of new large/medium rock structures; constraining natural morphological processes and reducing, compared to present, the movement of sediment offshore and downdrift from the coastline. As for the short term, the proposals would maintain the present artificial 'holding' of the coastline with a hard line of rearward coastal defences and an artificially nourished beach. There will continue to be an impact on coastal water bodies, both direct and indirect, due to the redistribution of nourishment sediments offshore and southwards, with potential (uncertain) effects on intertidal and subtidal habitats within the Lincolnshire and Wash (Outer and Inner) water bodies. The installation of structures will reduce the movement of sediment and will therefore have a different (possibly reduced) impact on downdrift habitats than scenario 1; this will need to be informed by scheme design. Whilst the	**N**	No mitigation required – but actions recommen-ded in Section 6.7.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	construction of structures will have a negative impact on shoreline habitats and benthic invertebrates due to their physical footprint, there is potential for the structures to act like a reef and attract colonisation of macroalgaes and invertebrates within the gaps between the rock, with potential for habitat gain and possible improvement in water body status (Lincolnshire water body). Through continuing to provide a wide beach, the strategy will continue to manage the risk of erosion and flooding and will help prevent the loss of beach habitat that would otherwise occur. Associated with this, there will be continued protection from saline inundation during high water events for river, lake and groundwater water bodies. Although there is less certainty, no change in WFD status/potential is anticipated and the proposals will not result in a deterioration of current surface water ecological status or potential across the strategy area. However, it will exacerbate the degree of modification. In terms of Protected Areas within the study area, the proposed strategy will not compromise the achievement of the WFD objectives, although further monitoring and modelling is proposed to better understand coastal change resulting from the proposed medium and long-term strategy proposals. The strategy will prevent saline flooding of groundwater inland used for drinking water. With the implementation of mitigation and monitoring (together with flexibility in the design of future medium and long-term schemes), the strategy will not adversely affect the integrity of any European sites.		

6.7.4 Mitigation recommendations/further actions

Although the WFD assessment has concluded that both of the proposed strategy scenarios will not result in a deterioration of current water ecological status or potential, nor cause failure to meet surface water GES /GEP by the target timeframe, nor permanently prevent or compromise the relevant environmental objectives being met in other water bodies, the following actions are recommended to manage the impacts on the water environment.

- Recommendations for further assessment, baseline monitoring and improving the understanding of the implications of any physical changes in coastal processes and morphology are provided in Sections 6.5.4 and 6.13.
- There are existing measures and quality controls in place to ensure that material deposited on the beach is as close as possible to the native sediment, including physical and chemical properties. This will minimise any potential contamination risks. There are also existing measures in place to minimise the release of fines during recharge campaigns, such as ensuring the dredger discharges at high water during slack water and selection of equipment to ensure as little sediment is disturbed through construction as possible.
- Any work associated with implementation of the strategy will need to be fully compliant with the Environment Agency's and the MMO's emergency procedures with respect to pollution incidents.
- As highlighted in Section 6.4, mitigation may be required in order to avoid adverse effects on habitats and species in European sites and shellfish waters downdrift of the nourishment zone. Continued monitoring will be necessary to inform what interventions are necessary, and is likely to differ between scenario 1 and 2.

- There are limited options for addressing mitigation measures identified for the river water bodies, but as part of the scheme design, consideration should be given to undertaking modifications to the outfall structures e.g. to reduce fish entrainment. Under scenario 2, consideration could also be given to incorporating outfalls into scheme design.
- In planning the siting, dimensions and location of new rock structures, consideration should be given to habitat creation opportunities.

6.8 Climate (Objective 11)

6.8.1 Objectives

Objective 11: Minimise contribution, reduce vulnerability and enable adaptation to future climate change

6.8.2 Receptors considered

	Sub-topic	Receptors/opportunities scoped in
11	Climatic factors	• Potential contribution of flood risk management actions to climate change (e.g. carbon emissions, use of materials). • Vulnerability of flood risk management actions to climate change. • Adaptability of flood risk management actions to address future changes in sea level rise/climate change.

6.8.3 Assessment of potential effects

	Sub-objectives	Assessment criteria
11.1	Minimise contributions to future climate change	• *Will the proposals contribute to climate change?*
11.2	Reduce vulnerability to future climate change	• *How vulnerable are the proposals to climate change?*
11.3	Enable adaptation to future climate change	• *Can the proposals adapt to future climate changes?*

With the benefit of more than two decades of 'Lincshore' beach nourishment, the project has collected a considerable amount of data on nourishment material (sand) transportation (from dredge site to shoreline) and fuel consumption: elements which significantly contribute to the project's carbon emissions. Since 2010, the project has estimated and recorded the carbon impacts on an annual basis using the Environment Agency developed carbon calculator tool (v2.1, 2007). To provide an even more comprehensive baseline record, the same tool has been used to calculate carbon impacts dating back to the 2006 campaign (the 2006 and 2007 campaigns being the last campaigns where the beaches were still being built up to a comprehensive design standard). A summary of these impacts shows that carbon impacts averaged over the last 12 years are estimated at 10,450 tonnes fossil CO_2 and the average impacts over the last ten years are slightly lower at 9,170 tonnes fossil CO_2.

The analysis provides the basis for comparing forecast carbon impacts for the two scenarios going forward. It noted that in the long term strategic case there would be very large 'do nothing' carbon impacts associated with eventual loss of assets and infrastructure together with the wholescale translocation of the current population. 'Do nothing' carbon impacts were not assessed as this option is not acceptable under the current management policy.

Both scenarios in the short, medium and long term will generate carbon. This is an unavoidable consequence of defending the frontage. However preliminary estimates of carbon generation based on the estimated nourishment volumes in the future and the placement of control structures are:

Short, Medium & Long term practically 2021 to 2120	**Scenario 1**	OR	**Scenario 2**
	Continue to maintain open beach **Cash cost 1,500 (£ million)**		**Introduce control structures with beach management** **Cash cost 709 (£ million)**
	Whole Life Carbon Calculator * 2,110,000 Tonnes Fossil CO_2		**Whole Life Carbon Calculator * 850,000 Tonnes Fossil CO_2**

* These estimates are based on long term predictions and form the basis of the assessment in this section.

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
11.1	Continuing beach nourishment in the short term will have a regular carbon[29] footprint as a result of required transport, construction and monitoring activities on an annual basis, including: • the transport of construction plant and people to/from the strategy area/nourishment sites; • movement of the marine dredger between the licensed offshore source site (currently up to 20 km offshore) and the nourishment sites; • movement of construction plant onshore to create the required beach profiles at the nourishment sites; • fuel use during site establishment, construction processes, the disposal of any waste materials and annual beach profile and environmental monitoring. Although the natural sand material sourced and used for beach nourishment does not in itself generate any additional carbon, that generated by these construction and transport activities has the potential to directly contribute to climate change. The level of carbon generation could increase over time as additional nourishment material is required to provide the required standard of protection in response to sea level rise (as a result of climate change). There will also be carbon generated from the activities required to maintain the landward sea walls on an ongoing basis in the short term, although this would be small in comparison with the nourishment works.	**X** *Perm, Rev, Reg, ST*	Yes – see Section 6.8.4
11.2	The proposals to continue the current approach of annual beach nourishment and sustain the standard of flood protection provided in line with predicted sea level rise will reduce the vulnerability of the people, infrastructure and environment to the potential effects of future climate change in the short term.	**+** *Perm, Rev, Reg, ST*	None required

[29] Carbon is defined as carbon dioxide equivalency (CO_2e), which is expressed in tonnes.

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	However, the reliance on an annual programme of beach nourishment to sustain the required level of flood protection means that there is an inherent vulnerability within the proposals – as the level of protection provided could be compromised by a lack of funding at any point.		
11.3	The planning and design of the annual beach nourishment can be readily adapted to sustain the standard of protection to keep pace with predicted (albeit small) changes in sea level arising from climate change in the short term.	**++** *Perm, Rev, Reg, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
11.1	As described in the short term, the continuation of annual beach nourishment in the medium term will generate carbon as a result of the transport, construction and monitoring activities required each year. The amount of carbon generated as a result of the described activities will significantly increase over time, commensurate with the increased volume of beach nourishment material required to provide a sustained standard of flood protection. In the medium to long term, the volume of nourishment materials required to keep pace with climate change will increase and the offshore material source may be further away, implying longer transit times for dredgers and a higher carbon footprint. There will be a carbon footprint associated with both the ongoing maintenance of the existing landward seawalls/defences in the medium term and the potential raising of these defences, as and when required to provide a higher backstop to the beach, in the long term. This will include transport and construction activities and the carbon associated with the production of the materials that form these raised structures. Unless major advances are made in the pursuance of carbon emission reduction from the dredging, transporting and placing of nourishment material, then the long term carbon footprint will continue to rise exponentially. Estimates for carbon emissions vary, but assuming similar rates of carbon emissions from the scheme (using present estimates as a baseline), production of fossil CO_2 (tonnes) will increase threefold in 100 years from approximately 10,000 tonnes CO_2 per annum to some 30,000 tonnes CO_2 per annum.	**XX** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.8.4
11.2	In the medium term, the proposals for the current programme of annual beach nourishment will sustain the standard of flood protection provided in line with predicted sea level rise, and will continue to reduce the vulnerability of the people, infrastructure and environment to the potential effects of future climate change.	Medium term **++** *Perm, Rev, Reg,*	No mitigation required – but actions recommen-ded in

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	Whilst these benefits will continue, the potential vulnerability of the proposals to climate change and sea level rise in the long term may increase as the volume of nourishment material required significantly increases with associated potential constraints on availability; there may also be physical constraints in terms of retaining a beach at a sufficiently high level to sustain the required standard of flood protection. As in the short term, the reliance on an annual programme of beach nourishment to sustain the required level of flood protection in the medium to long term means that there is an inherent vulnerability within the proposals – as the level of protection provided could be compromised by a lack of funding at any point.	*MT to LT* Long term **+** *Perm, Rev, Reg, MT to LT*	Section 6.8.4
11.3	As described in the short term, the planning and design of the annual beach nourishment can be adapted to sustain the standard of protection to keep pace with predicted changes in sea level arising from climate change in the short term – with higher and wider beach levels and if required, raised rearward sea wall defences in the long term to provide a raised backstop.	**++** *Perm, Rev, Reg, MT to LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
11.1	The introduction of cross-shore rock structures, together with an associated reduced frequency beach nourishment regime (every 5 to 10 years), in the medium term will have both a significant one-off and a less frequent regular carbon footprint as a result of required transport, construction and monitoring activities. For the construction of the new structures, this will include: • the transport of construction plant and people to/from the strategy area/nourishment sites; • sea-based movement of the barge transporting the rock material required for the new structures between the material source site (potentially Norway) and the beach frontage; • movement of construction plant onshore to construct the rock structures along the beach; and • fuel use during site establishment, construction processes, the disposal of any waste materials and associated monitoring.	Medium term **XX** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.8.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	In addition, activities associated with the reduced frequency beach nourishment regime in the medium to long term will be as previously described – except that the overall carbon footprint will be significantly reduced by comparison over time given the reduced frequency and overall volume of nourishment material required. However, in terms of this activity, the amount of carbon generated is likely to increase over time, where an increased volume of beach nourishment material is required to maintain a sustained standard of flood protection. There will also be a carbon footprint associated with both the ongoing maintenance of the existing landward seawalls/defences in the medium term, and the potential raising of these defences, as and when required, to provide a higher backstop to the beach in the long term. This will include transport and construction activities and the carbon associated with the production of the materials that form these raised structures. Again, unless major advances are made in the pursuance of carbon emission reduction from the mining, transporting and placing of rock and the dredging, transporting and placing of nourishment material, then the long term carbon footprint will be substantial, but not as significant as Scenario 1. Estimates for carbon emissions vary, but assuming similar rates of carbon emissions from the scheme (using present estimates as a baseline), production of fossil CO_2 (tonnes) will increase, but at a much reduced rate compared to Scenario 1. Annual figures are difficult to compare directly as some years will include rock structures and following this most years will have minimal works. However, over the 100 years, the total carbon footprint for Scenario 2 is estimated to be approximately 40% of the Scenario 1 total.	Long term **X** *Perm, Rev, Reg, MT to LT*	
11.2	In the medium term, the proposals will sustain the standard of flood protection provided in line with predicted sea level rise through the construction of new rock structures and associated beach nourishment. This will continue to reduce the vulnerability of the people, infrastructure and environment to the potential effects of future climate change. The provision of rock structures and the associated reduction in sand losses will improve the level of vulnerability offered by comparison with the annual beach nourishment regime. However, there remains some potential vulnerability to climate change and sea level rise in the long term.	Medium term **++** *Perm, Rev, Reg, MT to LT* Long term **+** *Perm, Rev, Reg, MT to LT*	No mitigation required – but actions recommen-ed in Section 6.8.4
11.3	The rock structures to be constructed in the medium term will be designed with the potential to be adapted to sustain the present standard of flood protection in accordance with predicted changes in sea level arising from climate change. The structures can be added to with additional rock material to provide the required standard; the supplementary beach nourishment can	**+** *Perm, Rev, Reg, MT to LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation /actions**
	be increased in frequency or volume as required, subject to monitoring; and the rearward seawalls can be raised/widened as required.		

6.8.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the adverse effects on climate predicted during the future implementation of the strategy proposals as described in Section 6.8.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Sub-objective 11.1: Contribution to climate change

The calculated carbon impact scores are based on historical records and calculations. As such they invariably assume that material dredging and placing efficiencies will remain similar to present day values. There are opportunities to reduce carbon impact through improvements in dredger design and operation that may occur in the future (e.g. larger, more fuel efficient, more use of renewable resourced vessels), optimising the volume of material required through design; although this could be countered by having to obtain material from licensed source sites which are further away from the Lincolnshire shores than those used at present.

In terms of the future implementation of the strategy proposals, there is a strong case for reducing carbon impacts in the long term under scenario 2 (the introduction of control structures) compared to scenario 1. This is mainly down to the significant reduction in nourishment required following the provision of the structures and the theoretical one-off placement of the structures (within the limitations of getting the optimum performance from the structures, i.e. not having to modify/relocate these structures to improve their beach retention performance). The calculation for scenario 2 currently assumes that rock material will be sourced and transported by sea from Norway. Other sources and methods of transport will affect this score, but even a significant re-estimate of this upwards will not change the significant difference in scores.

Sub-objectives 11.2 and 11.3: Vulnerability and adaptability to climate change

No mitigation measures required as the requirements of these sub-objectives have been met.

6.9 Historic environment (Objective 12)

6.9.1 Objectives

Objective 12: Conserve, and where possible enhance, the historic environment, heritage assets and their settings

6.9.2 Receptors considered

	Sub-topic	Receptors/opportunities scoped in
12	Contribution to heritage and landscape	• The coastal heritage of the seaside towns, historic townscape/landscape/seascape (Figure G.7) and heritage assets of the strategy area providing significant benefits to the local community particularly the aspects of wellbeing, education and a "sense of place"; and contributing economically via heritage tourism.
	Designated heritage assets	• Designated heritage assets and their settings (i.e. scheduled monuments, registered parks and gardens, protected wreck sites, listed buildings, conservation areas) within the strategy area at risk from flooding or potentially affected by flood risk management actions (Figure G.8).
	Non-designated heritage assets	• Significant known non-designated heritage assets or 'clusters' of known non-designated heritage assets and their setting within the strategy area, based on the Lincolnshire HER (Figures G.9 (a-d)). This will be agreed with LCC to screen and strategically determine the potentially sensitive features that could be affected by the strategy.

As discussed in Section 5.3, various commitments were made at the scoping stage of the SEA and numerous comments were received from Historic England and LCC in response to the SCD regarding the proposed scope of the assessment of effects on the historic environment within the strategy area. To address these, a document was prepared setting out the specific approach and data used which was provided to Historic England and LCC in August 2017 (refer to Appendix J). No responses were received and the proposed approach was undertaken as described in Appendix J.

6.9.3 Assessment of potential effects

	Sub-objectives	Assessment criteria
12.1	Conserve the key characteristics of the historic landscape/townscape along the coastal frontage, in urban areas and at the seaside resorts	• *Are the proposals sympathetic to the local character of the historic environment, including the characteristics of the historic landscape or areas of townscape value (e.g. Conservation Areas) and seaside resort heritage?* • *Will the proposals affect the contribution of the historic environment to the tourism economy, sense of place and community wellbeing within the strategy area?*
12.2	Manage harm to, and where possible enhance, designated heritage assets	• *Will the proposals change the risk of flooding to nationally designated heritage assets (Scheduled Monuments, Registered Park and Gardens, Protected Wreck sites, listed buildings) and locally designated heritage assets (listed buildings, Conservation Areas) within the strategy area; or directly affect their physical structure/condition or setting?*
12.3	Manage harm to locally listed and known undesignated archaeological and palaeo-environmental assets along the coastal frontage, where relevant to the assessment as agreed with LCC Historic Environment Officer	• *Will the proposals affect known significant locally listed or undesignated archaeological and palaeo-environmental assets along the coastal frontage within the strategy area, where identified as potentially sensitive in consultation with Lincolnshire County Council Historic Environment Officer?* • *Will the proposals encroach on undeveloped land, which may present a risk of encountering archaeological remains?*

	Sub-objectives	Assessment criteria
12.4	Support the contribution of the historic environment to the local tourism economy, sense of place and community well being	• *Could the proposals include/promote opportunities for heritage-led regeneration or heritage-based tourism, including traditional seaside tourism?* • *Where known, is there any potential for loss of access to heritage resources?*

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
12.1	Overall, this proposal would sustain the current programme of coastal flood defence that provides protection to historic landscape/seascape of the strategy area. It would manage the risk of flooding to the surrounding settlements and protect the existing landscape/seascape character. The historic landscape of Zone B comprises two distinct areas; in the north is the Mablethorpe Outmarsh, and to the south, from the northern limit of Anderby parish, is the Skegness Holiday Coast (Figure G.7). The Mablethorpe Outmarsh is characterised by planned enclosure following the 18th and 19th century drainage of the marshes. Medieval settlement cores are located on the higher ground outside of the former marshes. Coastal defences in this area are historically embankments, and include the 'Crooked Bank' and 'Sea Ditch/Dyke' which may be of medieval origin. The post-medieval landscape is dominated by development related to the rise of the coastal tourism during the 19th and early 20th centuries. The Skegness Holiday Coast is characterised by an open landscape of large modern fields deriving from the consolidation of earlier field patterns and drainage of the marshes. Older settlements are dispersed and located on areas of higher ground. The largest settlements are focused along the coast and developed during the 19th and 20th centuries due to tourism, although the historic origins of these settlements are still legible. The importance of tourism to the area is further attested by the original Butlins holiday camp at Ingoldmells and the numerous static caravan parks. Coastal defences in this area include historic embankments and modern concrete structures, particularly along the Skegness foreshore. The key characteristics of the seascape of the strategy area (Character Area 7 - East Midlands Coastal Waters) are summarised below (URS/Scott Wilson 2011): • Flat, low lying dynamic coastal landscape demonstrating a complex array of natural processes; • Temporal seascape character heavily influenced by the tides and the exposure of vast sand flats at low tide; • Extensive linear coastal geometry creating long sweeping views along the coastline and out to sea; • Perception of land and sea is strongly influenced by dunes and intertidal areas which presents a wild and remote character; • Remote character influenced in places by concentrated urban settlements, commercial activities and both on and offshore wind farm developments;	**N**	None required

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	• Recreational value of seascape represented by coastal resorts with much of the coastal waters designated as RYA racing and sailing areas. The beach is an important contributor to the economy, which historically was the driver for development through seaside tourism. The proposal would have no effect on the character of the historic landscape/seascape.		
12.2	Overall, this proposal would sustain the current programme of coastal flood defence that provides protection to the 270 designated assets (Figure G.8) within the strategy area. The risk of flooding to these assets would not be altered – they would continue to benefit.	**++** *Perm, Rev, Reg, ST*	None required
	Within Zone B (Figures G.9 b and c), there are 16 designated assets within a coastal zone that extends 1 km either side of the mean high-water mark that are at risk of being directly affected by the scheme. All of these assets are Grade II listed buildings, which fall into two clusters at either end of the zone. In Zone B (north), eight listed buildings are present within Mablethorpe and Sutton parish. These assets have limited, if any, intervisibility with the foreshore itself due to intervening buildings, vegetation and the prevailing low-lying topography. For example, the two listed buildings within Mablethorpe (Tennyson's Cottage and associated Pump) are both entirely screened from the foreshore by the existing substantial sea bank and associated vegetation. Similarly, for the cluster of three listed buildings at Furlongs Road, Sutton-On-Sea (Wavelands, Lindum and Marsoville), which comprise early 20th century holiday cottages constructed from Great Eastern Railway carriages, there is no intervisibility with the foreshore due to the intervening substantial sea bank. As such, it is considered that there would be no adverse impact on these assets by this option due to changes to their setting. The significance of these assets derives from their historic and architectural interest, particularly their historical and evidential value in respect of the development of tourism within the zone. Any small contribution to their significance derived from setting would be unaffected. In Zone B (south), a further eight listed buildings are present within Ingoldmells and Skegness parishes. The one designated asset within Ingoldmells parish, is a former gardener's office within the Butlins holiday camp. This is the last remaining chalet of the original pre-war resort built by Sir William Butlin. The significance of this asset derives from its historical interest, particularly its evidential and historical value in respect of the development of tourism within the zone. The asset is isolated from the foreshore by existing defences and vegetation and there would be no impact to its significance through changes to its setting. Six of the assets within Skegness have no direct visual relationship with the coastline due to intervening buildings and vegetation; as such it is considered there would be no impact on these assets by this option. Only the Jubilee Clock Tower shares some limited direct intervisibility with the foreshore along Tower Esplanade. The significance of this asset derives from its historical and architectural interest and any contribution from setting is considered to be secondary. The ability to appreciate the	**N**	None required

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	evidential, historical and aesthetic values of the asset from the foreshore are considered to make a small positive contribution to its significance and would be unaffected by this option. None of the above designated assets within the 1 km coastal zone would have their physical structures impacted by this proposal.		
12.3	Overall, this option would sustain the current programme of coastal flood defence that provides protection to the 2,448 non-designated assets recorded within the Lincolnshire Historic Environment Record (HER) within the strategy area. The risk of flooding to these assets would not be altered – they would continue to benefit.	**++** *Perm, Rev, Reg, ST*	None required
	Within Zone B, there are 107 non-designated assets within a coastal zone that extends 150 m either side of the mean high-water mark that are at risk of being directly affected by the scheme. Significant clusters of non-designated assets within Zone B include: • Mablethorpe and Sutton parish: traces of medieval settlement remains are known on the foreshore at Sutton-on-Sea (HER MLI43422); there are also numerous wreck sites recorded on the foreshore; further remains of fishing boats were also noted by the Donna Nook to Gibraltar Point Rapid Coastal Zone Assessment (RCZA) for English Heritage (Humber Field Archaeology, 2007)[30]. • Huttoft parish: the RCZA noted two possible inlets associated with an enclosing bank that may indicate previously unidentified landing places. • Anderby parish: the RCZA identified a possible haven associated with medieval earthworks. • Chapel St Leonards parish: medieval salt production sites are recorded within the southern limit of the parish on the foreshore (HER MLI41624, MLI41626); there is also a cluster of modern defensive features at Chapel Point (HER MLI43279, MLI98823, MLI98824); the RCZA noted evidence for a well-preserved palaeo-landscape within this parish. • Ingoldmells parish: regionally significant Iron Age and Romano-British salt production sites have been identified on the foreshore at Ingoldmells Point (HER MLI41637, MLI41639, MLI41645) and c.1 km to the south (HER MLI41650, MLI41663). Historic mapping, LiDAR and aerial photographs do not provide any further definition to the extents of these sites. • Second World War defensive structures present along the foreshore. The Historic England Intertidal and Coastal Peat Database records 16 entries for Zone B. Peat deposits and forest features have been identified at: Addlethorpe; Anderby Creek, Chapel Point; Chapel Six Marshes; Ingoldmells; Mablethorpe; Sutton-On-Sea; Trusthorpe; and Wolla Bank.	**N**	No mitigation, but actions recommen-ded in Section 6.9.4

[30] https://historicengland.org.uk/images-books/publications/rczas-donna-nook-gibraltar-point/

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	The current programme of beach nourishment provides protection from erosion to the identified non-designated assets of archaeological interest, particularly the regionally important salt production remains at Ingoldmells, and the palaeoenvironmental/ archaeological deposits present within this zone. The majority of these sites have no above-ground presence; as such it is considered that there would be no impact on the setting of these assets. It is acknowledged that the dynamic nature of nourishment activities results in occasional direct impacts on non-designated assets and palaeoenvironmental deposits exposed during storm events and erosion.		
12.4	The current programme of beach nourishment provides a key tourist attraction, a sandy beach, that forms a central component of the traditional seaside holiday experience within the strategy area. In combination with the extant historic sea defences, the beach is considered to contribute to the sense of place of the strategy area and community well-being. Non-designated assets present on the foreshore would continue to be buried under the nourished beaches. While this may preclude the investigation of these assets, it also ensures their long-term preservation.	**++** *Perm, Rev, Reg, ST*	None required
	There would be no loss of access to designated assets.	**N**	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
12.1	As described in the short-term, the continuation of the current beach nourishment programme in the medium to long term would not harm the key characteristics of the historic landscape/seascape.	**N**	None required
12.2	As described in the short term, the continued beach nourishment would provide continued flood protection to the designated heritage assets within the strategy area in the medium to long term through beach nourishment. There would be no harm to the physical structures or settings of these assets.	**++** *Perm, Rev, Reg, MT to LT*	None required
	As described in the short term, there would be no harm to the physical structures or settings of these assets.	**N**	None required
12.3	As described in the short term, this option would provide continued flood protection to the non-designated heritage assets within the strategy area in the medium to long term through beach nourishment.	**++** *Perm, Rev, Reg, MT to LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	As described in the short term, there would be no harm to the physical structures or settings of these assets, although consideration of the setting of any assets should be made during the raising/widening of landward seawalls in the long term.	Long term **X** *Perm, Rev, Reg, MT to LT*	Yes- see Section 6.9.4
	The current programme of beach nourishment provides protection from erosion to the identified non-designated assets of archaeological interest, particularly the regionally important salt production remains at Ingoldmells, and the palaeoenvironmental deposits present within the coastal zone. The majority of these sites have no above-ground presence and are protected by the nourished beaches. However, as noted above, the nourishment programme is a dynamic process and storm events and erosion could lead to the exposure of non-designated assets and palaeoenvironmental/archaeological deposits that could then be subject to degradation or loss.	**N**	No mitigation, but actions recommen-ded in Section 6.9.4
12.4	As described in the short-term, the continuation of the current beach nourishment programme would protect and support the local tourism economy, including any contribution derived from heritage.	**+** *Perm, Rev, Reg, MT-LT*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
12.1	Overall, this proposal would provide protection to the historic landscape of the strategy area from the risk of flooding.	**++** *Perm, Rev, Reg, MT to LT*	None required
	However, the introduction of rock armoured structures would alter the character of the current seascape from an open beach to a compartmentalised beach and could alter or sever current views along the beach (see above). The proposed structures would be least sympathetic in Zone B (north) where the foreshore is less developed and abuts the Mablethorpe Outmarsh historic landscape character area. In Zone B (south), the Skegness Holiday Coast historic landscape character area is considered to be less sensitive to	**X** *Perm, Rev, Reg, MT to LT*	Yes- see Section 6.9.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	the introduction of rock armoured structures along the adjacent foreshore due to the past levels of development present. While the introduction of rock armoured structures within Zone B would lead to a physical and visual change to the character of the seascape, and to a lesser degree the adjacent historic landscape character areas, it should be noted that the current landscape/seascape is itself a product of successive episodes of coastal flood management strategies spanning back to at least the medieval period. Defensive structures would not be out of character with the historic landscape/seascape when considered in the wider historical context and evolution of the strategy area.		
12.2	Overall, this proposal would provide protection to the 270 designated assets within the strategy area from the risk of flooding.	**++** *Perm, Rev, Reg, MT to LT*	None required
	Within Zone B, there are 16 designated assets within a coastal zone that extends 1 km either side of the mean high-water mark that are at risk of being directly affected by the scheme. All of these assets are Grade II listed buildings. All of the assets are situated to the west of the current defences, away from the areas of the proposed rock armoured structures, and would not be physically impacted by this option. While it is acknowledged that the wider landscape/seascape settings of these assets would be altered by the introduction of new physical and visual elements, given the absence of intervisibility with the foreshore from all but one of the assets (Jubilee Clock Tower), and the identified limited contribution to their significance derived from setting, it is considered that there would be no impact on these designated assets by this option.	**N**	None required
12.3	Overall, this proposal would provide protection to the 2,448 non-designated assets recorded by the Lincolnshire Historic Environment Record (HER) within the strategy area.	**++** Perm, Rev, Reg, MT-LT	None required
	As discussed above, there are a number of clusters of non-designated assets of significance on the foreshore that could be affected by the introduction of rock armoured structures. During the construction phase, excavation within the footprints of the proposed structures, along access routes, and associated with tying the structures in to the existing defences, which include historic sea banks, could physically impact non-designated assets and palaeoenvironmental/archaeological deposits. Areas of particular sensitivity include: the regionally significant Iron Age and Roman salt production remains at Ingoldmells Point (HER MLI41637, MLI41639, MLI41645) and c.1 km to the south (HER MLI41650, MLI41663); medieval salt production remains at Chapel St Leonards (HER MLI41624, MLI41626); and medieval settlement remains at Sutton-On-Sea (HER MLI43422).	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.9.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	The potential for encountering palaeoenvironmental deposits along the entire foreshore within Zone B is recognised. This proposal could result in a reduction in beach levels between the proposed rock armoured structures possibly leading to the exposure of non-designated assets and palaeoenvironmental/archaeological deposits. This could result in direct impacts on these assets through erosion. Of particular relevance to the overall character of Zone B is the non-designated Ingoldmells Butlin's holiday camp (HER MLI87079). This lies immediately to the west of the foreshore and embodies the importance of tourism to the strategy area. This proposal would alter the wider setting of this asset through the introduction of new physical and visual elements along its foreshore setting. There are clusters of non-designated WWII defensive structures within Zone B including: pillboxes, searchlight batteries and aircraft obstructions identified by the RCZA within Chapel-St-Leonard parish, including assets at Chapel Point (HER MLI43279, MLI98823, MLI98824); and further pillboxes, anti-glider banks and trenches within Ingoldmells and Skegness parishes. This proposal could impact on these assets through alteration to their settings, particularly the severing of any designed defensive views or inter-relationships between assets. The majority of the non-designated assets recorded within the coastal zone comprise findspots and buried archaeological assets. While it is acknowledged that the wider landscape/seascape settings of these assets (where still present) would be altered by the introduction of new physical and visual elements, the contribution to significance derived from the setting of these assets is considered to be negligible. Therefore, there would be no impact on the majority of the non-designated assets by this option through changes to their settings.		
12.4	Overall, this proposal would provide flood protection to those elements of the historic environment (designated and non-designated assets and the historic landscape, as identified above) of the strategy area that contribute to the local tourism economy, sense of place and community well-being. Non-designated assets present on the foreshore would be buried under the rock armoured structures. While this may preclude the investigation of these assets, it also ensures their long-term preservation.	**+** *Perm, Rev, Reg, MT to LT*	None required
	The introduction of rock armoured structures along the foreshore could allow for the enhancement and promotion of the historic environment of the strategy area. For example: • Archaeological works conducted in advance of, or during, the construction works could provide insights into the palaeoenvironmental and archaeological resource present (research dividends). The findings of the works would feedback into local and regional research frameworks. Any new insights into the salt producing sites/medieval flood defences along the foreshore could help reinforce the local sense of place; • Engagement with local interest groups and heritage specific public outreach event could be undertaken as part of the strategy;	**+** *Perm, Rev, Reg, MT to LT*	No mitigation, but actions recommen-ded in Section 6.9.4

MEDIUM TERM (6 to 35 years) (Stages 2 to 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub -obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	• Information boards/signage could be incorporated along the foreshore to identify and inform visitors about the historic environment, including the findings of any archaeological works; and • Heritage trails could be implemented linking to the designated and non-designated assets within the coastal zone.		
	There would be no loss of access to designated assets as a result of this scenario.	**N**	None required

6.9.4 Mitigation recommendations/further actions

Actions are recommended to avoid and/or mitigate the neutral or adverse effects on the historic environment predicted during the future implementation of the strategy proposals and described in Section 6.9.3. These actions are described in terms of relevant scenarios/proposals and time periods.

Sub-objective 12.1: historic landscape

Introduction of structures (scenario 2) in the medium and long term.

- Further assessment of the historic landscape character should be undertaken to identify its sensitivity to change, and significance, in order to help inform the siting of the proposed structures.

Sub-objective 12.2: designated assets

No mitigation measures required as the requirements of this sub-objective have been met.

Sub-objective 12.3: non-designated assets

Beach nourishment (short, medium and long term):

- The current beach nourishment programme, if sustained, should be subject to archaeological monitoring to ensure that non-designated assets and/or palaeoenvironmental/archaeological deposits exposed through erosion are identified, recorded and protected during subsequent nourishment, where appropriate.
- Further detailed assessment of the non-designated assets and areas of high palaeoenvironmental/archaeological potential should be undertaken to assess the impacts of any raising/widening of landward sea defences. The results of such an assessment would inform the design and need for further archaeological investigation/mitigation, which should be agreed with the LCC Historic Environment Officer.

New rock structures (medium to long term):

- Further assessment of the siting of the proposed structures should be undertaken at the project stage to minimise any negative setting impacts on the historic landscape character and non-designated assets, and identify opportunities for enhancement (refer to plans in Appendix G).
- Detailed assessment should be undertaken at the project stage to highlight non-designated assets and areas of high palaeoenvironmental/archaeological potential

that would be directly impacted during the construction of the rock armoured structures, and any raising/widening of landward sea defences.

- Archaeological mitigation works should be undertaken in advance of, and during, construction works within the footprints of the rock armoured structures where these are located over non-designated assets and areas of high palaeoenvironmental/archaeological potential that cannot be avoided.
- Monitoring to ensure the identification of non-designated assets or palaeoenvironmental/ archaeological deposits exposed through erosion due to changes to beach levels, following the introduction of the rock armoured structures, should be undertaken. Appropriate mitigation should be implemented to protect such assets/deposits during subsequent nourishment or to preserve them through investigation and recording.
- Further assessment of siting of the proposed structures would need to be undertaken at the project stage to minimise any negative settings impacts to the historic landscape character and non-designated assets, and identify opportunities for enhancement (refer to plans in Appendix G).
- The physical and visual impact of the rock armoured structures on the historic landscape/seascape character should be minimised as far as possible through the careful consideration of the placement, form, size, colour and material used (see Section 6.10), subject to engineering constraints, where the avoidance of such impacts is not possible.

Sub-objective 12.4: positive contribution of historic environment

Both scenarios (short, medium and long term):

- Ensure provision for public outreach is scoped into further stages of archaeological investigation.
- Consider the placement of the rock armoured structures in respect of known heritage assets and archaeological remains and the prospect for providing enhancement to these assets through the control of access arrangements, provision of viewing platforms (if appropriate), and enhancement of the legibility of the historic landscape and heritage assets (for example heritage trails and information boards).

6.10 Landscape and visual amenity (Objective 13)

6.10.1 Objectives

Objective 13: Maintain and enhance the quality and character of the landscape and seascape.

6.10.2 Receptors considered

	Sub-topic	Receptors/opportunities scoped in
13	Landscape/ seascape character	• Aspects of landscape character (using ELDC Landscape Character Assessments[31]), seascape character (using the 2011 seascape character assessments; refined by consultation in 2012)[32] and historic landscapes (using data from the Lincolnshire Historic Landscape Characterisation project[33]) of the strategy area, in particular along the coastal frontage, at risk from flooding or potentially affected by flood risk management actions.
	Visual amenity	• Significant changes in views for beach users/residents/visitors along the coastal frontage will be considered where appropriate.

The receptors considered for this assessment have been determined through desk study of the ECUS Ltd (2009) East Lindsey District Landscape Character Assessment. The area considered forms part of the Lincolnshire Coast and it is considered that three main landscape character areas would be influenced by the proposals as described in the document above:

1. *K1 Donna Nook to Gibraltar Point Naturalistic Coast* - considered to be a highly distinctive and very intact natural landscape with very few detractors. It forms a very narrow strip of sandy beaches screened on its inland side by concrete sea defences and dunes. Otherwise it is a very open and exposed landscape with views up and down the beaches and across "big skies" including off shore windfarms to the north at Skegness (outside of the character area), and some urban influences in views from the coastal resorts including the rollercoaster at Ingoldmells. There are high levels of nature conservation protection across large areas of the character area and particularly in the southern stretches closer to Gibraltar Point. It is a mostly natural landscape apart from some minor intrusion of ministry of defence structures. However, in recent years the most significant forces for change have come from the beach nourishment occurring once a year to maintain an artificial 'holding' of the coastline with a hard line of coastal defences and an artificially nourished beach. This is to protect inland areas from flooding and to prevent erosion of the beaches and the sea defences by tidal forces. There is general access for visitors to the beaches for recreation, to have access to the nature conservation areas, onshore and offshore fishing areas with the number of visual receptors of the landscape being higher during the summer season. The overall landscape character sensitivity is considered to be **high** as landscape and visual impacts could not be easily mitigated. Any development would have to be very sensitive to the naturalistic nature of the landscape.
2. *J1 Tetney Lock to Skegness Coastal Outmarsh* – forming the hinterland to K1 Donna Nook to Gibraltar Point it is a simple rural landscape comprising mainly flat coastal plain. This landscape creates some open views towards The Wolds AONB to the west of the Lincolnshire Coast area and towards onshore windfarms at Consholme, but also to the "big skies" of the coastline and beyond to offshore windfarms at Skegness (outside of the character area). Its pattern has been largely influenced by

[31] ECUS Ltd (2009) East Lindsey District Landscape Character Assessment. Prepared on behalf of East Lindsey District Council.
[32] URS/Scott Wilson (2011) *Seascape Characterisation around the English Coast (Marine Plan Areas 3 and 4 and Part of Area 6 Pilot Study).* Natural England Commissioned Report NECR106. Description of key characteristics updated in Marine Management Organisation (2012) Seascape character assessment. East Inshore and East Offshore marine plan areas.
[33] https://www.lincolnshire.gov.uk/residents/environment-and-planning/conservation/archaeology/lincolnshire-historic-landscape-characterisation-project/

the drainage systems required for the agricultural land uses. There are also areas of enclosure due to other areas of gently undulating landform and shallow valleys together with localised wooded areas and hedgerows. Urban influences occur around the seaside resorts of Skegness, Ingoldmells, Sutton Sea and Mablethorpe. There are increasing pressures on these areas from caravan park developments, light industry and theme parks. Industrial land uses detracting from the rural landscape include the Tetney oil storage tanks and the Theddlethorpe gas terminal. Public rights of way are intermittent and often only link to settlements "*Overall the landscape character sensitivity is considered to be **moderate** to **high** but lower in areas influenced by localised industrial and urban areas"*

3. *D1 Wainfleet Wash Saltmarsh* – outwith the study area, although near to Gibraltar Point and extending south beyond the study area, this landscape character area is formed by an extensive network of open saltmarsh and inter-tidal mud and sand flats with winding creeks. It is a largely inaccessible, remote and wild landscape. There are views of wide horizons and "big skies" which are influenced by changing tides, light and weather conditions. The saltmarsh vegetation created by these flats provides valuable habitats for wildfowl, wading birds and other wildlife and is protected by many international and national nature conservation designations. Settlement is infrequent and usually associated with the RAF Wainfleet Air Weapons Range. Access is limited and therefore the number of visual receptors is small; however, due to the very open nature of the landscape, any change to the landscape would be very visible. It is a very distinctive, naturalistic and dramatic coastal landscape. Forces for change come from the RAF base and the need for structures such as the helipad. "*The overall landscape character sensitivity of Wainfleet Wash Saltmarsh is considered to be **high**."*

Interestingly, the description of "naturalistic" coastline given in the above document is at odds with the descriptions given in the Historic Landscape Characterisation (further details in Section 6.9). This area may appear to be "naturalistic" because of the sandy beaches and dunes with a hinterland of outmarsh and agricultural land use. Historically, in order to protect the landscape, it has been drained through a series of dykes to allow for agricultural practices on the rich alluvial soils. The area has always been at threat from flooding with the use of groynes along the beaches and sea defence walls. Were it not for the man-made influences to protect the landscape, the natural landscape would more likely be marshland with a retreating coastline and many of the settlements abandoned or destroyed through flooding. In recent times the sea flood risk management activities have been softer in approach and appearance, dredging up sands from the sea bed and depositing them on the beach to maintain the beach levels.

6.10.3 Assessment of potential effects

	Sub-objectives	**Assessment criteria**
13.1	Manage risk to landscape character from tidal flooding	• *Will the proposals lead to the introduction of features which are unsympathetic to the present character of the landscape/seascape and cause deterioration?* • *Will the proposals improve the value of the existing landscape/seascape (i.e. the aesthetic satisfaction derived from a landscape type), compared to the present day?*
13.2	Protect landscape and seascape character from adverse changes	
13.3	Maximise opportunities to enhance landscape and seascape character and value.	
13.4	Protect significant sea views where these contribute to the quality of the landscape	• *Will the proposals result in an adverse change to sea views along the coastal frontage where these significantly contribute*

		to the value and quality of the coastal landscape?

SHORT TERM (0 to 5 years) (Stage 1)			
Open beach with annual nourishment			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
13.1	Beach nourishment would continue to protect the character of the present landscape and visual amenity of the beaches and coastline landscape character area (K1 Donna Nook to Gibraltar Point Naturalistic Coast) by providing an artificial 'holding' of the coastline with an artificially nourished beach. It would manage the risk of flooding to the surrounding settlements and landscape in the hinterland landscape character area (J1 Tetney Lock to Skegness Coastal Outmarsh) and therefore protect the existing landscape character.	**+** *Perm, Rev, Reg, ST*	None required
13.2	Maintenance of the beaches with a wide, high, open beach backed by hard defences/embankments/dunes would protect the present landscape/seascape character of the coastal frontage (K1 Donna Nook to Gibraltar Point Naturalistic Coast) from deterioration of the beach frontage. Therefore, this would maintain the “status quo” of this landscape character area.	**N**	None required
	The dynamic nature of nourishment activities that occur on the beaches would result in continued direct impacts on the coastal landscape K1 Donna Nook to Gibraltar Point Naturalistic Coast, considered to be highly sensitive to changes. Construction impacts cause the greatest effects as the activities would occur on an annual basis when the machinery to carry out the works is present within the vicinity, and the beach levels are “topped up” to required heights. However, once these activities are over, the landscape is restored to its existing character.	**X** *Perm, Rev, Local, ST*	Yes – see Section 6.10.4
13.3	There are limited opportunities in the short term to enhance the characteristic landscape features of the coastline. This would maintain the existing *status quo*.	**N**	None required
13.4	The annual disturbance of construction activities to carry out the beach nourishment would mean that this scenario continues to bring negative visual effects on receptors with little opportunity for mitigation as these activities cannot be screened in views. However, they are temporary in nature and would largely occur out of season when there are fewer receptors. There are likely to be more visual impacts in Zone B between Mablethorpe and Ingoldmells where works are known to be needed. Visual receptors are likely to be from the beach access only as sea defence bunds, dunes or walls restrict views to the beaches from the wider landscape areas. There would be no permanent change in existing views.	**X** *Perm, Rev, Local, ST*	None required

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
13.1	As described in the short term, ongoing beach nourishment in the medium to long term would continue to protect the character of the present landscape and visual amenity of the beaches and coastline landscape character area (K1 Donna Nook to Gibraltar Point Naturalistic Coast) by providing an artificial 'holding' of the coastline with an artificially nourished beach, and continuing to raise beach levels to maintain the required level of protection. It would manage the risk of flooding to the surrounding settlements and landscape in the hinterland landscape character areas (J1 Tetney Lock to Skegness Coastal Outmarsh and D1 Wainfleet Wash Saltmarsh) and therefore protect the existing landscape character.	**++** *Perm, Rev, Reg, MT to LT*	None required
13.2	As described in the short term, maintenance of the beaches with a wide, high, open beach backed by hard defences/embankments/dunes would protect the present landscape/seascape character of the coastal frontage (K1 Donna Nook to Gibraltar Point Naturalistic Coast) from deterioration of the beach frontage were there not to be any intervention. The increase in the height of the beaches, increasing the scale of the beaches would have a very minor effect on landscape character. Overall, it would maintain the "status quo" of this landscape character area.	**N**	None required
	In the long term, the seawalls will need to be raised due to the increased height of the beaches. This would have a negative effect as the sea wall will be increased in scale creating further severance of the beach from the landscape/townscape immediately landward.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.10.4
	As described in the short term, the dynamic nature of nourishment activities that occur on the beaches would result in continued direct impacts on the coastal landscape K1 Donna Nook to Gibraltar Point Naturalistic Coast, considered to be highly sensitive to changes. Construction impacts cause the greatest effects as the activities would occur on an annual basis when the machinery to carry out the works is present within the vicinity and the beach levels are raised to required heights. However, once these activities are over, the landscape returns to its existing character.	**X** *Perm, Rev, Local, MT to LT*	
13.3	The nourishment is likely to occur in rotation at different parts of the coastline over the time period. There may be opportunities in dune areas and earthbanks that remain undisturbed for a number of years, to enhance landscape habitats to maximise the coastline habitats, and also to help stabilise the dunes and earthbanks. This would help to enhance the characteristic landscape features of the coastline.	**+** *Perm, Rev, Local, MT to LT*	None required
13.4	The annual disturbances of construction activities for beach nourishment would mean that this scenario continues to bring negative visual effects on receptors with little opportunity for mitigation as these activities cannot be screened. However, they are temporary in nature and would largely occur out of season when there are fewer receptors. There are likely to be more visual impacts in Zone B between Mablethorpe and Ingoldmells where works are known to be needed. Visual receptors are likely to be from the beach access only as sea defence bunds, dunes or walls restrict views to the beaches from the wider landscape areas.	**X** *Perm, Rev, Local, MT to LT*	Yes – see Section 6.10.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 1: Open beach with annual beach nourishment and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
	Additional visual effects will be experienced by the landward receptors close to the beach when the sea wall is raised to accommodate the higher beach in Zone B. Further disconnect will be experienced between the beach and the receptors behind the sea wall who are at lower levels than the sea level and the beach. These receptors would have views of the increased height of the wall which is likely to have a negative effect.		

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
13.1	The artificial 'holding' of the coastline with a hard line of rearward coastal defences, an artificially nourished beach and a series of new large/medium rock structures would manage the risk of flooding to the surrounding settlements and the surrounding rural landscape character areas of J1 Tetney Lock to Skegness Coastal Outmarsh and D1 Wainfleet Wash Saltmarsh.	**++** *Perm, Rev, Reg, MT to LT*	None required
13.2	Change to the present landscape/seascape character of the coastal frontage will occur in the medium term with the introduction of numerous large and medium rock structures that will transect the wide high open beach. The number of these structures will increase over time depending on the need for them along the coastline resulting in sequential negative impacts. These features will be least sympathetic to the present character of K1 Donna Nook to Gibraltar Point Naturalistic Coast, where the coastal frontage is undeveloped and rural in nature. The presence of the groynes would interrupt the natural geometry of the coast. These effects will also continue to be in combination with the beach nourishment required and associated activities until beach levels have stabilised.	**XX** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.10.4
13.3	There is little opportunity to enhance the landscape and seascape character of the receiving landscape (K1 Donna Nook to Gibraltar Point Naturalistic Coast). Although this scenario would “hold back” the coastline from creeping south, it would be carried out in an artificial way.	**N**	Yes – see Section 6.10.4

MEDIUM TERM (6 to 35 years) (Stages 2 and 3) to LONG TERM (36 to 100 years)			
Scenario 2: Introduce structures along the coast and additional works in the long term			
Sub-obj	**Assessment of proposals**	**Signifi-cance**	**Mitigation/ actions**
13.4	The presence of these structures will create a less 'natural' appearance than the present open beach and will modify and sever views along the coast from the beach, limiting views to the beach area between the larger structures. The effects of the strategy would happen sequentially over a 10 to 15 year period as structures are constructed. The inclusion of any larger scale fishtail groynes would have a greater negative visual impact due to their height, limiting views over the tops by beach users. The effects are also greater at low tide as more of the structure is in view. The views of 'big skies' would still be available to all visual receptors. Appendix L presents visualisations of these proposed structures at low and high tide at two locations within the strategy area. Consultation with local stakeholders and the wider public (refer to Section 5) identified that the introduction of the groynes would be welcomed. It is perceived that the groynes would create some enclosure along the beach and that this would provide an enhancement to the visual amenity of the beach. Taking these opinions into account it is considered that the changes in views would be considered to have a minor adverse effect overall. The supplementary beach nourishment and/or sand recycling activity would reduce to every 5 to 10 years in the long term. Therefore, the disturbance from the construction activity would happen less frequently. The existing open views along the beaches will have been enclosed by the groynes and so views of construction operations would also be more limited to receptors closer to the works, with only glimpses of the tops of machinery working between the groynes from a distance. Overall, this would lessen the visual effects of the supplementary beach nourishment works in the long term. In the long term it could be said that the receptors would become somewhat habituated to the activities required to protect the coastline and the rock groynes would become a recognised and accepted feature of the coastline views through generations.	**X** *Perm, Rev, Reg, MT to LT*	Yes – see Section 6.10.4

6.10.4 Mitigation recommendations/further actions

The following actions are recommended to avoid and/or mitigate the adverse effects on the landscape environment predicted during the future implementation of the strategy proposals as described in Section 6.10.3, and to deliver identified enhancements. They have been adapted from a recent report by Alison Farmer Associates (2016)[34]. These actions are described in terms of relevant scenarios/proposals and time periods.

Sub-objective 13.1: Manage risk to landscape character from tidal flooding

No mitigation measures required for this objective as the landscape objective has been met.

[34] Alison Farmer Associates (2016) *Touching the Tide Landscape Partnership, Suffolk Coastal Sea Defences, Potential Landscape and Visual Effects*, Final Report 2016.

Sub-objective 13.2*:* Protect landscape and seascape character from adverse changes

Beach nourishment (short, medium and long term):

- Minimise the number of sites undergoing beach nourishment at any one time to limit the scale of construction impacts.
- The profile of the beaches post nourishment should complement the geometry of the coast and not be out of scale with any one area.

New rock structures (medium to long term):

- Coastal defences should, wherever possible, complement the geometry of the coast. Hard defences and sandscaping may change the alignment of the coast by creating hard points and embayments which may disrupt or reinforce simple lines.
- Avoid the continued incremental expansion of rock defences along the coast and consider the junction with natural beach using a gradation in the size of rock material.

Sub-objective 13.3: Maximise opportunities to enhance landscape and seascape character and value

Beach nourishment (short, medium and long term)

- Seek opportunities to improve the habitat and landscape connectivity between inland areas and the coast and create greater species diversity and scenic quality over time by planting areas of dunes or earthbanks which remain unchanged through the beach nourishment process.
- There is also an opportunity in the short term to link to the Structures on the Edge (SOTE) project whose theme is developing small scale art-led interventions as part of an evolving linear gallery of coastal architecture[35].

New rock structures (medium to long term)

- Height increase in hard defences and sandscaping may change the alignment of the coast by creating hard points and embayments which may disrupt or reinforce simple lines. Careful consideration of the finished appearance of structures.
- Existing habitats or geological sites along the coast may experience change as a result of natural processes such as erosion, inundation or coastal squeeze. Where the rock groynes may cause direct impacts, consideration should be given to creating new habitat types and opportunities for replacement of lost habitat elsewhere.
- Seek to simplify coastal sea defences and to remove features which are no longer functional.
- Seek to combine the new coastal features with other desired public realm enhancements such as boardwalks and piers to minimise the introduction of additional “hard” coastal features. There are significant opportunties to improve the key qualities of the landscape under both scenarios during the implementation of the strategy by, for example, improvements to the coastal frontage, embanked defence line and the rural inland landscape, public access, green linkages, focussed views, scale and texture, seating and shelter, habitat creation and screening. All potential

[35] 'SOTE has provided a series of semi-remote coastal locations for artists and architects to realise permanent installations and interventions that will enhance our relationship with the natural environment of the UK coastline. The potential sites on the 10 mile stretch of coast between Chapel St. Leonards and Mablethorpe on the Lincolnshire coast. SOTE could be platforms, landings, hides, shelters, havens, lookouts or other structures designed by artists and architects for the appreciation, enjoyment and understanding of the coastal environment. They may have a specific purpose such as wave watching; cloud spotting; star gazing or climate observation, they may react to or interact with the natural elements in dynamic and surprising ways or they may simply provide a shelter or contemplative place for quiet appreciation.' https://www.lincolnshire.gov.uk/bathing-beauties/structures-on-the-edge

opportunities should be considered as the works arising from the strategy are developed.

Sub-objective 13.4: Protect significant sea views

Beach nourishment (short, medium and long term)

- Minimise the number of sites undergoing beach nourishment at any one time to limit the visibility of construction impacts.
- Seek opportunities to improve the visual connectivity between inland areas and the coast and create greater visual diversity and scenic quality over time by planting areas of dunes or earthbanks which remain unchanged through the beach nourishment process.

New rock structures (medium to long term)

- Consider height, material and length of groynes and also the spacing of groynes along the beach. Avoid visual clutter, retain openness and views to key landmarks.
- Cross-shore coastal defences such as groynes may also create visual clutter undermining simplicity and openness. Keep the palette of rock groyne materials conservative to avoid visual clutter i.e. avoid the introduction of a range of different rock types and colours.
- The rock groynes should therefore be designed with care giving consideration to form, size, colour, material and location.
- Seek to combine and integrate the new positioning of new coastal features with other desired public realm enhancements such as boardwalks and piers to minimise the visual clutter of additional coastal features.

6.11 Summary of the predicted effects of the strategy

Table 6.1 presents a summary of the predicted effects of the strategy proposals/scenarios in the short, medium and long term, prior to the implementation of any recommended mitigation measures that may reduce the significance of these effects. A descriptive summary of these predicted effects are provided in Section 8.1. Section 8.2 also identifies the actions recommended to mitigate these effects and the further actions recommended to deliver the identified positive benefits.

Table 6.1: Summary of predicted effects

Topic/ Receptor	Ref	SEA objective	Ref	Sub-objectives	Scenario 1			Scenario 2		Mitigation/ further actions* recommended?
					ST	MT	LT	MT	LT	
Population, health and local economy	1	Manage risk to the health of people and local communities	1.1	Minimise the vulnerability of people and public health to tidal flooding	++	++	+	++	++	No
			1.2	Avoid risk to life through an adaptive approach	++	++	+	++	++	No
	2	Avoid damage to, and enhance where possible, recreation and tourism	2.1	Avoid damage to and loss of use of significant visitor attractions and recreational resources	++	++ x	+ + + x	+ ++ x	+ ++ x	Yes – Section 6.2.4
			2.2	Support opportunities to attract investment in coastal tourism and improve visitor attractions and recreational resources	+	+	+	+	+	No
	3	Minimise risk to economic activities and facilitate the creation of economic opportunities	3.1	Minimise the vulnerability of areas of significant employment/economic activity to tidal flooding	++	++	++	++	++	No
			3.2	Ensure compatibility with planned development and regeneration	N	N	N	N	N	Yes – Section 6.2.4
			3.3	Support and facilitate the creation of economic opportunities	N	++	+	++	++	No
			3.4	Avoid damage to commercial fishing activity and shellfisheries	N X	? x	? x	? x	? x	Yes – Section 6.2.4
Material assets	4	Minimise risk to infrastructure	4.1	Minimise the vulnerability of transport infrastructure to tidal flooding	++	++ x	++ x	++ x	++ x	Yes – Section 6.3.4

Topic/ Receptor	Ref	SEA objective	Ref	Sub-objectives	Scenario 1			Scenario 2		Mitigation/ further actions* recommended?
					ST	MT	LT	MT	LT	
			4.2	Avoid damage to, or loss of, critical services/infrastructure	+ + X	++ X	++ X	++ X	++ X	Yes – Section 6.3.4
	5	Use resources sustainably	5.1	Minimise the consumption of finite materials	x	xx	xx	x	x	Yes – Section 6.3.4
Biodiversity, flora and fauna	6	Maintain, and where possible, enhance flora and fauna	6.1	Avoid damage to/loss of, and, where possible enhance, internationally and nationally designated sites of nature conservation interest	++ N x	++ N ? x	++ N ? x	++ N ? x	++ N ? x	Yes – Section 6.4.4
			6.2	Avoid damage to/loss of, and where possible enhance, locally designated sites of nature conservation interest	+ N	+ N x	+ N x	+ + + x	+ + + x	Yes – Section 6.4.4
			6.3	Avoid damage to/loss of coastal and marine habitats and dependent species of conservation concern, where known to be present	+ N x	+ N x	+ N x	+ x	+ x	Yes – Section 6.4.4
			6.4	Avoid disturbance and damage to fish/shellfish and their spawning/nursery grounds	N	X/?	X/?	X/?	X/?	Yes – Section 6.4.4
			6.5	Support opportunities to enhance biodiversity through habitat restoration or creation within the strategy area	N	N	N	+ N	+ N	Yes – Section 6.4.4
Soils, geology and geomorphology	7	Protect geological diversity and work with natural	7.1	Avoid damage to/loss of, and where possible enhance, nationally and locally	++	++	++	+ x	+ x	Yes – Section 6.5.4

Topic/ Receptor	Ref	SEA objective	Ref	Sub-objectives	Scenario 1			Scenario 2		Mitigation/ further actions* recommended?
					ST	MT	LT	MT	LT	
		geomorphological processes		designated sites of earth heritage interest						
			7.2	Work with natural geomorphological processes, wherever possible, including sediment movement	N	N	N	x	x	Yes – Section 6.5.4
	8	Minimise risk to sites with pollution potential	8.1	Minimise the vulnerability of areas of known/potential contaminated land and landfills to tidal flooding	++	++	++	++	++	No
Land use	9	Support varied land uses along the coastline	9.1	Manage risk to agricultural land, in particular that of highest quality, from tidal flooding	++	++	++	++	++	No
			9.2	Manage risk to other key land uses from tidal flooding	++	++ x	++ x	++ x	++ x	Yes – Section 6.7.4
Water and hydromorph-ology	10	Maintain, and where possible improve, the quality of water resources as defined by the WFD	10.1	Protect the quality of surface waters and groundwater and support the delivery of WFD objectives and requirements for classified water bodies and Protected Areas	N	N	N	N	N	Yes* – Section 6.7.4
Climate	11	Minimise contribution, reduce vulnerability and enable adaptation to future climate change	11.1	Minimise contributions to future climate change	x	xx	xx	xx	x	Yes – Section 6.8.4
			11.2	Reduce vulnerability to future climate change	+	++	+	++	+	Yes – Section 6.8.4
			11.3	Enable adaptation to future climate change	++	++	++	+	+	No

Topic/ Receptor	Ref	SEA objective	Ref	Sub-objectives	Scenario 1						Scenario 2				Mitigation/ further actions* recommended?
					ST		MT		LT		MT		LT		
Historic environment	12	Conserve, and where possible enhance, the historic environment, heritage assets and their settings	12.1	Avoid damage to the key characteristics of the historic landscape/townscape along the coastal frontage, in urban areas and at the seaside resorts	N		N		N		++	x	++	x	Yes – Section 6.9.4
			12.2	Manage risk to heritage assets from tidal flooding and avoid damage to/loss of, and where possible enhance, nationally and locally designated heritage assets	N	++	N	++	N	++	N	++	N	++	Yes* – Section 6.9.4
			12.3	Avoid damage to/loss of locally listed and known undesignated archaeological and palaeo-environmental features along the coastal frontage, where relevant to the assessment as agreed with Lincolnshire County Council Historic Environment Officer	N	++	N	++	N	++	x	x	++	x	++	Yes – Section 6.9.4
			12.4	Protect and support the contribution of the historic environment to the local tourism economy, sense of place and community well being	N	++	+		+		N	+	N	+	Yes* – Section 6.9.4

Topic/ Receptor	Ref	SEA objective	Ref	Sub-objectives	Scenario 1			Scenario 2		Mitigation/ further actions* recommended?
					ST	MT	LT	MT	LT	
Landscape and visual amenity	13	Maintain and enhance the quality and character of the landscape and seascape	13.1	Manage risk to landscape character from tidal flooding	+	++	++	++	++	No
			13.2	Protect landscape and seascape character from adverse changes	N x	N x	N x	xx	xx	Yes – Section 6.10.4
			13.3	Maximise opportunities to enhance landscape and seascape character and value	N	+	+	N	N	Yes – Section 6.10.4
			13.4	Protect significant sea views where these contribute to the quality of the landscape	x	x	x	x N	x N	Yes – Section 6.10.4

6.12 In-combination effects with other plans and proposals

This assessment also considers the potential effects of the proposed strategy in combination with other key plans and strategies either in place or in development; details of which are provided in Section 3.4. Table 6.2 sets out the relationships between these plans and the proposed strategy and identifies where there is potential for in-combination effects (positive and negative) that should be considered as the strategy is taken forward and proposals developed.

This brief assessment identifies that the proposed strategy is generally compatible with the plans and strategies considered, taking into account their requirements. Further studies will be required at scheme design stage, which may include modelling of impacts, to ensure that no adverse in-combination effects result from the proposed works to implement the strategy. The key recommendation from this assessment is to continue liaison with the statutory bodies and organisations implementing/promoting the other plans to ensure that any potential interfaces/conflicts can be managed, and opportunities for efficiencies and additional benefits can be delivered.

Table 6.2: Assessment of in-combination effects with other plans and proposals

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
Development/spatial plans			
Adopted East Lindsey Local Plan, including a Core Strategy and Settlement Proposals (ELDC, July 2018)	Policies and proposals within the adopted East Lindsey Local Plan (July 2018) and associated documents, in particular those relating to Coastal East Lindsey (Strategic Policies (SP) 17 to 21), are broadly consistent with the recommendations of the proposed strategy: – The proposed strategy seeks to address risks to people and property from flooding with positive benefits to the local populations; whilst Local Plan policies (e.g. SP17 and SP18) recognise the level of risk and seeks to ensure future housing and leisure development in areas at risk from flooding is limited and appropriate given the level of risk. – The proposed strategy will also inform the implementation of development policies in Coastal East Lindsey. – Consistent with the proposed strategy, SP17 supports improvements to the existing flood defences, the creation of new flood defences and infrastructure associated with emergency planning. – The proposed strategy needs to be consistent with the Core Strategy policy (SP20) that supports appropriate development in the Skegness and Mablethorpe Foreshores and Sutton-on-Sea that contributes to the tourism economy, whilst not causing harm; and supporting the Wild Coast Vision. Any development along the foreshore will	Yes – potential for both positive benefits/ opportunites and negative effects	Liaison with ELDC (responsible for the delivery of the Local Plan proposals) will be required during the strategy implementation to minimise the potential for adverse effects and seek to deliver additional benefits/ opportunities.

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
	need to take into account the measures recommended for the proposed strategy. – The proposed strategy recommends actions to hold the existing coastal flood defence line, which is consistent with wider Local Plan policies to reduce flood risk and protect the environment. Potential in-combination effects could arise if any tourism or other developments identified in accordance with policies in the adopted East Lindsey Local Plan are constructed at the same time as works recommended in the strategy are implemented and there is potential for interaction. No specific proposals are identified and these are considered to be unlikely, but this should be kept under review.		
East Inshore Marine Plan (2014) **Three-year report on the East Marine Plans: 2014-2017 (Defra, 2017)**	The Marine Plan includes policies and objectives consistent with the environmental protection/enhancement objectives that have been applied during the SEA of this strategy. Of particular relevance to the strategy are policies AGG1 to AGG3 which relate to the extraction of marine aggregates, on which the present beach nourishment operations are reliant as noted within the Marine Plan. These objectives will be applied to the consenting of all activities within the Marine Plan area, ensuring that they are environmentally and socially acceptable. No conflicts are anticipated between the Marine Plan objectives and policies and the strategy recommendations, although changes in policies relating to the future availability of marine aggregates will need to be monitored. A review of the three-year progress report on the East Marine Plans (2017) on the achievement of the objectives set out in the East Inshore and Offshore Marine Plans also identified no additional issues or conflicts in relation to the proposed strategy, and no in-combination effects are anticipated.	No	No specific actions recommended, although ongoing periodic liaison with the MMO and review of any updates to/reviews of the Marine Plan will be required to ensure this conclusion remains valid.
Flood risk and water management plans			
Flamborough Head to Gibraltar Point SMP2 (HECAG, 2010)	The policies identified in the Flamborough to Gibraltar Point SMP2 for the strategy area were reviewed during the development of the proposed strategy and the recommendations of the proposed strategy to 'hold the existing defence line' are consistent with the SMP2 policies in the short, medium and long term in	No	No specific actions recommended, although ongoing periodic liaison with the HECAG and review of any updates to/reviews of the

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
	Zones A, B and C. No in-combination effects are predicted.		Flamborough Head to Gibraltar Point SMP will be required to ensure this conclusion remains valid.
The Wash SMP2 (East Anglia Coastal Group, 2010)	The policies identified in The Wash SMP2 (Gibraltar Point to Old Hunstanton) were reviewed during the development of the proposed strategy. The recommendations of the proposed strategy to 'hold the existing defence line' within the strategy area are consistent with the SMP2 policies for the policy development zone in closest proximity to the strategy area (between Gibraltar Point and Wolferton Creek) in the short, medium and long term (note that the SMP2 policies include the potential option of managed realignment in the medium to long term, subject to future monitoring of foreshore erosion). No in-combination effects are predicted.	No	No specific actions recommended, although ongoing periodic liaison with the East Anglia Coastal Group and review of any updates to/reviews of The Wash SMP will be required to ensure this conclusion remains valid.
Anglian RBD RBMP (2015)	The objectives and, where applicable, mitigation measures identified within the RMBP for water bodies (coastal, transitional, lake and groundwater) within the strategy area to achieve good status/potential have been taken into account during the development of the strategy and assessed within the SEA. Potential conflicts and opportunities have been identified and further actions recommended, as documented in Section 6.7 of this report, and in the separate WFD assessment (see separate Appendix B).	Yes – potential for both positive benefits/ opportunites and constraints to delivery	Specific actions identified in Section 6.7.4. No additional actions recommended, although ongoing periodic liaison with the relevant Environment Agency teams and review of the five yearly updates to the RBMP will be required (subject to future changes) to ensure this conclusion remains valid.
Anglian RBD FRMP (2015)	The FRMP identifies a series of flood risk management actions throughout the strategy area, including the preparation and implementation of the strategy itself. Potential in-combination effects could arise if any actions identified within the FRMP not included within the strategy recommendations are implemented at the same time as works recommended in the strategy. None are identified at the present time.	Yes – potential for both positive benefits/ opportunites and negative effects	Liaison between the Environment Agency and the organisations delivering those actions required during the strategy implementation to minimise the potential for adverse effects, and seek to deliver additional benefits/opportunities.

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
			In addition, ongoing periodic liaison recommended with the relevant Environment Agency teams and review of the five yearly updates to the FRMP will be required.
Humber FRMS (Environment Agency, 2007) **Comprehensive review currently underway**	The Humber FRMS seeks to manage the risk of flooding around the Humber Estuary in ways that are sustainable for the people who live there, the economy and the environment, taking into account natural estuary processes and future changes in the environment (built or natural), sea levels or the climate. It identifies key flood risk areas around the Humber estuary and proposes actions to manage such risk. A key issue within the Humber Estuary is coastal squeeze and the loss of internationally important intertidal habitat. The Humber FRMS is currently undergoing a comprehensive review. Although located to the north of the strategy area, there is limited physical connectivity between the strategy area and The Humber, and no in-combination effects are anticipated. Although the strategy proposals will not provide any additional intertidal habitat, opportunities should be considered.	No	Liaison between the Environment Agency and the partner organisations delivering those actions required during the strategy implementation to minimise the potential for adverse effects and seek to deliver additional benefits/opportunities.
East Lindsey Strategic Flood Risk Assessment (SFRA) (East Lindsey District Council, 2017)	The SFRA sets out the extent of flood risk to two zones - the Coastal Zone and Inland East Lindsey. These assessments are used to inform future sustainable growth and development within the strategy area. The reliability of the flood hazard and zone mapping that underpin these assessments are reliant on sustaining the present level of coastal/tidal flood protection provided by the strategy. However, although the two documents are closely interlinked and interdependent, there is no potential for additional in-combination effects.	No	No specific actions recommended, although ongoing periodic liaison with ELDC and review of any updates to/reviews of the SFRA will be required to ensure this conclusion remains valid.
Other plans			
Greater Lincolnshire Coastal Vision: The Greater Lincolnshire Local Enterprise	The Greater Lincolnshire Local Enterprise Partnership sets out a vision for the Greater Lincolnshire's Coast by 2030. It identifies a series of outcomes including: (1) sustaining and growing business and the economy; (2) sustaining and developing prosperity through	Yes – potential for positive benefits/ opportunities	Liaison between the Environment Agency and the organisations delivering those actions required during the strategy

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
Partnership (GLLEP) (2016)	infrastructure; and (3) protecting and sustaining the environment. This draws together a series of plans and initiatives to deliver these outcomes. The vision recognises the importance of the SGPS in providing a high standard of defence, protecting communities and critical economic assets and the provision of an amenity beach.		implementation to seek to deliver additional benefits/opportunities.
Wild Coast Vision	The Wild Coast Vision for the Lincolnshire coast seeks to deliver a sustainable natural coastal environment providing high quality facilities for communities and visitors, improvements for wildlife and contributing to a healthy local economy. Delivery of the vision is supported by the policies of the adopted East Lindsey Local Plan. In reducing flood risk, the proposed strategy will benefit the delivery of the Wild Coast Vision by manging risk to habitats and species landward of the coastal defences and protecting the features on which nature tourism can be developed. In addition, there is potential for positive and improved environmental benefits from the proposed strategy by linking any opportunities for ecological enhancement with the aspirations and proposals of the Wild Coast Vision.	Yes – potential for positive benefits/ opportunities	Liaison between the Environment Agency and the organisations delivering those actions required during the strategy implementation to seek to deliver additional benefits/opportunities.
Strategic developments			
Triton Knoll offshore windfarm	Triton Knoll Offshore Wind Farm (TKOWF) is being proposed by Innogy and partners and is located approximately 33 km east of the Lincolnshire coast. The Secretary of State granted a Development Consent Order (DCO) for the TKOWF on 12th July 2013. TKOWF will comprise 90 maximum 10 MW wind turbines with a total installed capacity of up to 900 MW. Offshore construction is planned to start in late 2019/early 2020. The Triton Knoll Electrical System (TKES) was granted a separate DCO on 27th September 2016. The TKES will connect the consented TKOWF to the National Grid substation at Bicker Fen, Boston, and would comprise offshore and onshore export cable circuits, landfall infrastructure (at Anderby Creek within the strategy area), an onshore substation, and works at the Bicker Fen substation. Construction of the TKES	Yes – potential for negative effects	Further liaison required with the proponent during the planning of continued beach nourishment works in the short term to consider and manage any potential interactions and effects arising should any construction works overlap.

Plan/strategy	Relationship to the strategy and potential for in-combination effects	Effects likely?	Recommended actions
	commenced in September 2018 and is planned to complete in 2020, prior to the strategy implementation. However, if this construction period extends, there is potential for in-combination effects on the local population and environment between works required to construct the onshore/offshore elements of the TKES within the strategy area and the continued beach nourishment operations in the short term.		
Viking Link interconnector project	The proposed Viking Link is a 1,400 Mega Watt (MW) high voltage direct current electricity link between the British and Danish transmission systems connecting at Bicker Fen substation in Lincolnshire, Great Britain and Revsing in Southern Jutland, Denmark. Viking Link will allow electricity to be exchanged between Great Britain and Denmark. The project is being jointly developed between National Grid Viking Link Limited and Energinet. Planning applications to the relevant local authorities were submitted in August 2017, and planning was granted following a successful appeal by Viking Link. It will also include the installation of submarine and underground cables between the converter stations which will make landfall at Boygrift, adjacent to Sandilands golf course within the strategy area. Once approved, construction of the Viking Link project is expected to commence in 2019 and be operational in 2022 – although these dates are likely to be delayed. There is potential for in-combination effects on the local population and environment between works required to construct the Viking Link onshore at Boygrift, and offshore – if works are undertaken in the same locations as, or concurrently with the onshore beach nourishment operations and the offshore dredge sites – and the routes between.	Yes – potential for negative effects	Further assessment and liaison required with National Grid, Viking Link Limited and Energinet during the planning of continued beach nourishment works in the short to medium term to consider and manage any potential interactions and effects arising from construction works that may overlap.

6.13 Proposed implementation and monitoring

6.13.1 Existing monitoring for the present beach nourishment programme

At present, physical monitoring is undertaken on an annual basis for the LBM project to measure beach levels at a range of locations (transects) and determine the location and volume of nourishment material required that year to sustain the required standard of protection.

An environmental monitoring programme was also established in 1996 to determine the impacts of the Lincshore beach nourishment scheme (as named at the time) on physical and biological attributes along the Lincolnshire coast. The original scope of the monitoring was based on the recommendations of the Environmental Statement for the initial scheme (National Rivers Authority, 1992). Following feedback from stakeholders, the monitoring has been modified over time and now includes consideration of impacts on geology and sediments, ecology and fisheries.

The aim of the environmental monitoring is to examine potential impacts on:

- the physical nature of the environment and benthic sediments: through particle size analysis assessing the range, size and distribution of sediments and their associated physical and chemical properties.
- the local biological community comprising:
    - Intertidal invertebrates living within beach sediments (benthic invertebrates).
    - Subtidal epifaunal invertebrates living on the seabed beneath the low tide mark – with a particular focus on brown shrimp (*Crangon* sp.) that form an important economic fish species.
- bivalve fisheries within The Wash.

The monitoring locations (beach transects and trawl survey locations) are shown on Figures 6.1 and 6.2. Areas inside the beach nourishment zone are surveyed in addition to 'control' sites outside of the nourishment zone. From 2016, an additional survey transect was added to the programme within The Wash to identify any impacts of the nourishment activity on the ecological and physical components of The Wash estuary.

Details of the methods used and the results of the analyses of data obtained throughout the monitoring period are published in an annual monitoring report; the latest being from 2018 (Environment Agency, 2018), presenting the results of the 2017 monitoring. Relevant results have been used to inform the assessments described in Section 6 of this report.

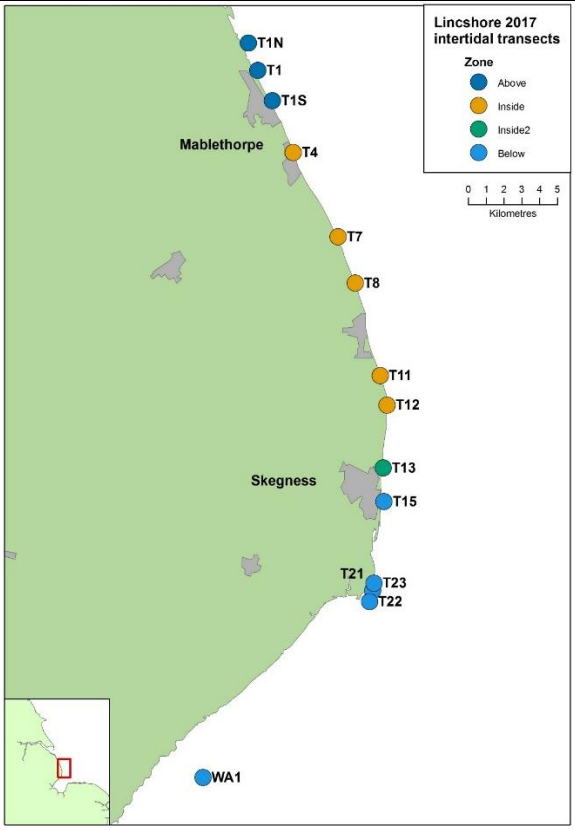


Figure 6.1: Beach transects sampled as part of the 2017 Lincshore ecological monitoring survey programme. (Source: Environment Agency, 2018[36])

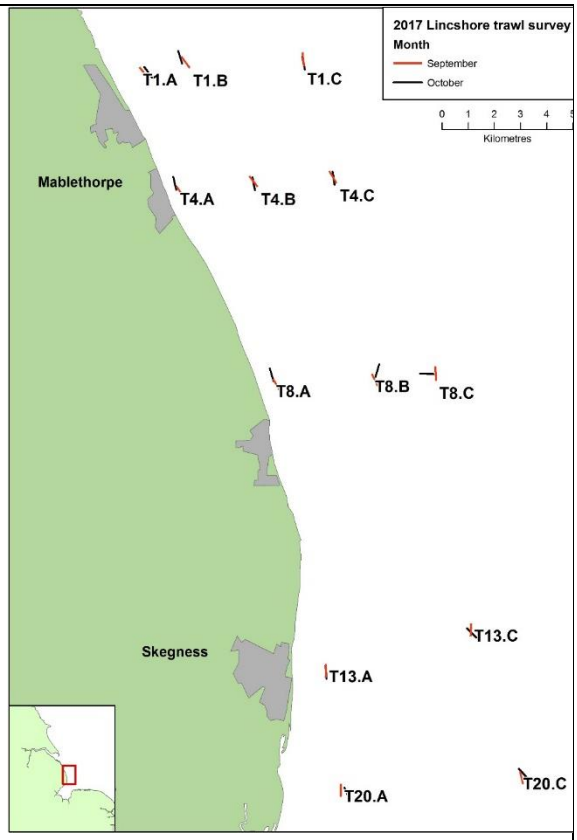


Figure 6.2: Location of 2.4 m beam trawls for the 2017 Lincshore ecological monitoring programme. (Source: Environment Agency, 2018)

6.13.2 Proposed monitoring regime during future strategy implementation

The assessment has identified a range of effects that will require actions and management as the strategy proposals are developed and implemented in the future. The key principles of implementation and monitoring of the strategy are to:

- Ensure that mitigation measures are fully implemented and effective;
- Monitor the potential adverse and uncertain environmental effects identified by this assessment, taking into consideration the SEA objectives;
- Monitor the delivery of the significant positive environmental effects identified by this assessment;
- Identify any unforeseen environmental effects;
- Avoid duplication of monitoring by utilising existing monitoring programmes.

Monitoring is important in evaluating any foreseen or unforeseen cumulative effects and can also be used to address any gaps in existing data (through the provision of a more detailed baseline) and any uncertainties. Given the uncertainty regarding the likely future timing and specifics of the strategy recommendations to be implemented in the medium to long term, the mitigation measures set out in Sections 6.2 to 6.10 (mainly further assessment, consultation

[36] Environment Agency (2018) Lincshore 2010-2017 Environmental Annual Monitoring Report: 2017.

and monitoring activities) have been developed to provide overarching recommendations to guide the future implementation of the strategy.

The proposed SEA monitoring regime to inform strategy delivery is provided in Table 6.3. This includes strategic level monitoring, which will allow the comparison of predicted effects with actual monitored effects, plus monitoring that is required at project level (but is not a complete list of all monitoring that will be required for projects that may arise from the strategy).

Table 6.3 also considers the monitoring and modelling requirements identified as part of the HRA (Appendix A), which includes the development of a Strategic Monitoring and Mitigation Action Plan to identify actions needed to manage uncertain effects on internationally designated conservation sites.

Responsibilities for monitoring will need to be agreed through liaison with partner organisations.

Key effects to be monitored in relation to both scenarios and across all time periods comprise:

- Objective 2: protection of the amenity function of the beach and landward defences – beach profile, water quality, Blue Flag status, access (England Coast path) and beach accessibility (using/adapting existing physical monitoring data).
- Objective 3: the status/yields of fisheries offshore and within The Wash within the zone of influence of the strategy (linked to existing monitoring/marine licence conditions).
- Objectives 3/4: the status of other infrastructure developments that could interface with the strategy proposals resulting in in-combination effects/potential for efficiencies.
- Objective 5: the availability of suitable nourishment material to maintain the adaptability and sustainability of the management approach.
- Objective 6: where potentially affected by the strategy proposals:
    - the reported condition/conservation status of designated habitats and species within/outwith designated sites.
    - Population/community survey data (third party) for habitats and species of conservation concern/value.
    - Benthic and epibenthic fauna of the inshore coastal waters (using/adapting existing monitoring regime).
    - Establishment of new habitats/species introduced along the coastal frontage – e.g. marram grass/pioneer dune planting; colonisation of new rock structures.
- Objectives 7/12: where potentially affected by the strategy proposals:
    - depth of protection from erosion for/condition of designated/important earth heritage and palaeoenvironmental sites along the beach (also Objective 10).
    - Continued beach profile montoring and interpretation (using/adapting existing monitoring regime) – to contribute to the dataset used to undertand shoreline behaviour and changes.
    - Monitoring of the physical changes resulting from the implementation of any new structures along the beach.
    - Monitoring of the continued development and changes to the Gibraltar Point complex.
    - Monitoring of any changes to The Wash – sediment tracer/fingerprinting studies; bathymetric monitoring of banks.

- Objective 10: the status/potential, WFD objectives and delivery of mitigation measures of/for waterbodies and Protected Areas (where relevant) within the zone of influence.
- Objective 11: actual levels of carbon emissions – on an annual basis, from construction and operation.
- Objective 13: changes in the character of the coastal landscape and seascape over time as a result of the introduction of new/larger structures.

Underpinning these proposals is the assumption that the current programme of physical and environmental monitoring will continue, albeit adapted as required, subject to consultation with stakeholders and regulators (i.e. NE, MMO). This will provide the optimum information to inform the delivery of the strategy and the sustainable management of flood risk along the coast, with minimal adverse environmental effects and maximum benefits. This will also provide a continuous data set relating to the present and future beach nourishment programme and enable the continued analysis and prediction of any longer term trends. However, within this period, a review of the efficacy of the present environmental monitoring regime is recommended.

The delivery of the strategy itself, which requires ongoing and periodic review, will also be informed by further understanding, modelling and policy/legislation changes, as well as monitoring of the risks associated with tidal flooding and erosion (e.g. coastal defence asset condition and flooding consequences).

Table 6.3: Proposed implementation and monitoring framework

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
2.1	Beach safety, access and amenity value	Beach nourishment exacerbating management issue of wind blown sand and restricting access along promenade walkway/ cycleways New structures interrupting beach access	Monitoring of beach profiles in sensitive locations – may need additional monitoring locations. Assessment of risks/hazards. Potential response: review and reprofile beach if required to maintain amenity and ease access to the beach/sea. Develop a plan, as part of project delivery to manage public access.	Beach profile >X:X (values to be determined) slope/gradient = trigger. H&S hazards/risks due to steep beach profile.	Annual beach profile monitoring and recording. Annual assessment of risk.	Risks to amenity identified and action taken to remove.
2.1	Water quality/Blue Flag beach status	Uncertain impact: potential reduction in beach amenity and bathing hazards from beach nourishment	Review of bathing waters monitoring data.	Reduction in water quality – below good.	Environment Agency monitor bathing waters weekly between May and September annually.	No impacts on bathing water quality as a result of the strategy.
3.4 and 6.4	Fisheries – strategy area and downdrift	Uncertain impact: potential for beach nourishment to affect (shell) fisheries	Continue existing measures (review) and monitoring regime at commercial (shell) fishery locations. Review available data – Eastern IFCA Modelling of potential physical geomorphological changes and associated effects on fisheries during and post strategy implementation	Reduction in fishing yields within nearshore waters and in status of commercial shellfisheries. Reduction in water quality.	Environment Agency monitor Brown Shrimp fishery at The Wash [frequency to be confirmed].	No impacts on epibenthic or demersal fisheries as a result of beach nourishment.
4.1	Transport and other infrastructure	Impacts of windblown sand on local roads	Liaison with ELDC and LCC to monitor windblown sand on local roads and maintain safe access. Potential response: road sweeping required	Visible sand appears to pose risk to road users.	Infrequent basis, as needed.	No risk to road users and infrastructure.

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
4.2	Interfaces with critical infrastructure	Uncertain impact: potential damage and in-combination timing impacts to cable landings and drainage outfalls from nourishment	Liaison with infrastructure providers/manager (including TKES and managers of Viking Link), and ELDC. Potential response: advance planning for project implementation. Plan and design integration of new infrastructure.	Project timings confirmed.	Regular liaison with relevant consultees, as needed.	No in-combination impacts or damage to infrastructure.
5.1	Availability of suitable nourishment material	Sourcing, removal and redistribution of recharge material within sediment system, affecting coastal morphology	Monitoring of geomorphological change.	To be confirmed following development of Strategic Monitoring and Mitigation Action Plan.	To be confirmed following development of Strategic Monitoring and Mitigation Action Plan.	To better understander geomorphological change and to avoid changes resulting from nourishment activities.
6.1	Designated sites –within and around Gibraltar Point and The Wash	Changes to intertidal and subtidal habitats (and associated bird species) from beach nourishment/physical changes – see HRA with regard to monitoring and modelling required in relation to the Saltfleetby to Theddlethorpe Dunes and Gibraltar Point SAC, Gibraltar Point SPA and Ramsar site, The Wash and North Norfolk Coast SAC, The Wash SPA and	Engagement with Natural England and RSPB. Continuation of present physical and environmental monitoring regime (and review) for the LBM in the short-term: - – Annual beach profile monitoring – Particle size analysis – Marine bethic invertebrates – Review of available fish/shellfish data Development of a Strategic Monitoring and Mitigation Action Plan, in line with the requirements of the HRA.	Review of LBM monitoring through submission of Annual Report. Natural England monitor the condition/conservation status of compartments in the Gibraltar Point and Wash Natura 2000 sites, and this will provide high level indicators of habitat	Annual review of LBM monitoring. Natural England monitor SPA/Ramsar/SAC status on a six yearly cycle [to be confirmed that this is the case]. Annual reporting of cumulative habitat change. Monitoring Plan to be developed prior. to	Support achievement of conservation objectives of the relevant Natura sites, allowing for adaptive management over time.

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
		Ramsar site, Inner Dowsing, Race Bank and North Ridge SAC	Potential response: review and if necessary revise strategy option and monitoring requirement relating to observed habitat change	extent and distribution. Triggers and early warning system identified in the Strategic Monitoring and Mitigation Action Plan will be agreed with Natural England.	Strategy implementation.	
6.2 and 6.3	Non-designated sites and marine ecology	Potential impacts on non-statutory conservation sites and marine species of conservation concern from nourishment and new structures	Engage with Lincolnshire Wildlife Trust. Review of population/community survey data (third party) for habitats and species of conservation concern. Review of benthic and epibenthic fauna data of the inshore coastal waters from existing monitoring regimes.	Existing environmental monitoring (review). Additional parameters/triggers to be confirmed by the wildlife trust in discussion.	Ad hoc.	No impacts on non designated sites and marine ecology from strategy implementation.
7.1	Protection of earth heritage sites	Potential damage to geological features (fossil saltmarsh and forest) from placement of rock structures and through exposure of deposits	Review of beach levels at sensitive locations through beach profile monitoring.	Depth of protection/degree of exposure Review of beach profile monitoring	Annual beach profile monitoring.	No impacts on geological features from strategy implementation.
7.2	Geomorphological changes,– along the coast and downdrift	Interruption of natural longshore drift from new rock structures	Monitoring of beach recharge material to ensure it meets required specification. Continuation of present physical and environmental monitoring regime (and review) for the LBM in the short-term:	Review of beach profile monitoring Sampled recharge material prior to nourishment does	Annual beach profile monitoring. Monitoring Plan to be developed prior to	No changes to coastal geomorphology from strategy

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
			– Annual beach profile monitoring – Particle size analysis Development of a Strategic Monitoring and Mitigation Action Plan, in line with the requirements of the HRA, which will include – Assessment, review and surveys (if required) to define an acceptable baseline e.g. review of shoreline behaviour analysis, environmental baseline data etc, and gap analysis – Programme of strategic level monitoring and modelling (together with proposed improvements to sediment transport models) to better understand geomorphological changes, sediment dynamics along the coastline, and the continued evolution of features and habitats. A process for the design, modelling and monitoring of any new structures associated with Scenario 2 to consider the impact on longshore and cross-shore sediment transport, interaction with tidal currents and potential consequences for downdrift areas.	not meet agreed specification Triggers and early warning system identified in the Strategic Monitoring and Mitigation Action Plan will be agreed with Natural England.	strategy implementation.	implementation.
9.2	Land use	Land-take in footprint of widened defences	Estimate areas and types of land use lost at each location at project level. Review project design to minimise losses.	To be confirmed at project level.	During project development.	Minimise land-take and impacts on land-use.

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
10.1	WFD status/potential – water bodies and protected areas (Natura 2000 sites and Shellfish waters)	No identified impact from strategy in isolation but monitoring recommended due to increased modification of waterbody. Potential for waterbody improvements or conflicts at project level in combination with the Anglian RBMP	Review existing WFD monitoring data – water bodies (coastal, transitional, river and groundwater), habitats and protected areas. Balance sheet of waterbody hydromorphological gains and losses associated with implementation of projects under, and associated with the strategy. Ongoing liaison with relevant EA teams. Review of five yearly updates to the RBMP. WFD assessment to be undertaken at project level to inform choices.	Changes to and new WFD monitoring data and updates to RBMP.	Ad hoc, based on data changes and RBMP updates.	WFD objectives are not compromised by strategy implementation. Contribution to RBMP Programme of Measures.
11.1	Carbon emissions	Annual carbon footprint of schemes from strategy implementation	Seek reduction in carbon emissions during project implementation e.g. efficient use of dredgers, reduced volume of materials required for construction etc.	Annual levels of carbon emissions.	Ad hoc, based on project development	Reduction in carbon emissions, as far as practically possible during strategy implementation.
12.3	Protection of heritage assets – erosion risks	Impacts on non-designated archaeological assets and palaeoenvironmental deposits from introduction of new structures and from erosion	Review of beach levels.	Beach profile monitoring (review). Depth of protection/degree of exposure.	Annual beach profile monitoring	No impacts on archaeology from strategy implementation.

Sub-objective	Receptor	Potentially significant or uncertain effect of strategy	Monitoring action and potential response	Measure/indicator/ trigger	Provisional timescale for monitoring	Target outcome
3.2 and in-combination effects	Other planned developments	Compatability with other planned development and regeneration	Review of relevant development proposals with ELDC and the MMO.	Identification of development proposals interfacing with the strategy proposals.	Annual assessment/review with ELDC and the MMO	No adverse in-combination effects. Potential for efficiencies identified.

7. Alternative options considered

From the starting point of the SMP policy to hold the line in the short and medium term, the development of the strategy considered more than 27 options to determine the preferred approach to managing flood risk in the most sustainable and affordable manner. The multi-staged process through which options were identified, considered and then taken forward or discounted – including detailed multi-criteria technical appraisals and stakeholder consultation – is described in Section 2.5. Full details of the option selection are available on request – contact details are shown in Section 1.4, reference *Option Selection and Scoring, Appendix K2* of the Strategy Appraisal Report.

Details of the multi-staged environmental appraisal of options undertaken to inform the development of the strategy are provided in Appendix C. Table 7.1 lists the alternative options that were considered for the strategy area during the development of the strategy. It highlights the primary reasons for not taking these forward and provides a summary of the key consequences in terms of population, health and economy and the natural environment (relative to the present/predicted do nothing option), whether positive, negative or uncertain.

The staged and detailed option appraisal process, within which environmental criteria have had a substantive weighting and influence, has ensured that those options with significant adverse environmental effects have been discounted and not formed part of the strategy proposals. This includes the do nothing and a range of do minimum options (i.e. approaches 1 and 2) that would result in significant adverse effects on the local population, economy and environmental features within low-lying areas of the coastal floodplain, and along the frontage as a result of increased tidal flood risk and the loss of the amenity beach. Potential options that increase the height/width of the landward seawalls without any associated beach nourishment (approach 4) were also discounted primarily because of the loss of the fronting beach and the effects on amenity and the local economy.

The range of options considered to segment the coast into discrete management sections (approach 5) present a range of opportunities for biodiversity enhancement, with appropriate siting and design, and may be considered to be environmentally preferred, depending on the details of the proposals to be developed and appropriate avoidance/mitigation of adverse effects. However, the costs and affordability of these options are greater than the alternative open beach options (approach 3) and were therefore discounted.

The remaining open beach options (approach 3 – with and without structures) will result in significant benefits in terms of sustaining the present level of flood protection, balanced with a range of adverse effects such as the increasing demand for nourishment materials (with an associated increasing carbon footprint and potential risks of damage to offshore habitats) by continuing the present management; and large scale changes in landscape and offshore sediment movement resulting from the introduction of new rock structures along the frontage. This mix of effects, as described in Table 7.1, means that there are no clear environmentally preferred options under approach 3, but many of the proposed options (including the proposals/scenarios set out in the draft strategy) would be environmentally acceptable, subject to appropriate mitigation. In Table 7.1 options rejected during the option appraisal process are coloured in red; whilst those recommended within the proposed strategy are coloured in green.

Table 7.1: Alternative options considered during the development of the strategy and the reasons for not taking forward as part of the strategy proposals

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
1	**Do nothing**[37]	Rejected due to a drop in standard of protection and due to significant adverse effects on population, economy and natural enviromment Option included as the economic base case throughout the assessment.	Population, economy and built environment • Signficant increase in risk to life, health and wellbeing of people and communities within low-lying areas at risk from flooding, with risks increasing over time. • Loss of amenity beach and in time, damage to coastal frontage with significant impact on tourism economy. • Saline flooding of agricultural land would reduce productivity with significant impacts on local economy. • Flooding of roads and reduction in/loss of access, with impacts on emergency services provision and community connectivity/viability. • Potential erosion and flooding of features of archaeological or heritage value along the coast and inland over time. • No requirement for continuous supply of beach materials and associated reduction in carbon footprint compared to present, but the costs/footprint of damage and reconstruction would be significant. • No ability to adapt to future changes in climate and associated sea level rise. Natural environment • Saline flooding of large areas inland over time with catastrophic impacts on terrestrial and freshwater habitats and species. • Loss/erosion of existing beach over time resulting in changes to coastal and sub-tidal habitats. • Uncertain impacts on designated habitats, species and fisheries down and up-drift of the strategy area. • No requirement for supply of dredged sand – avoids impact on habitats and species in these areas. • Potential transition to more 'naturally' functioning coastline, with potential benefits to Lincolnshire coastal water body due to reduction/removal of hydromorphological pressure. • Potential impact on groundwater due to saline intrusion resulting from flooding of hinterland. • Complete loss of and change in present landscape and amenity value. • Likely reduction in predominant southerly transport of sediment as nourishment operations cease with

[37] This option involves ceasing of all activities, resulting in erosion of the beaches, exposure and erosion of the underlying clay layer (within 2 to 5 years) and eventual failure of the sea defences.

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
			potential changes downdrift in terms of geomorphology etc. • As beach levels reduce, potential erosion of designated geological features (e.g. RIGS) and clay exposures known to be of paleo-environmental importance.
2	**Do Minimum: (reactive) options**		
2.1	Do minimum – doing the minimum works necessary such as emergency patch and repair + sand recycling as and when required.	Rejected due to a drop in standard of protection. Wave impacts and overtopping would progressive-ly increase.	<u>Population, economy and built environment</u> • Continued reduction in risk to people and communities within low-lying areas at risk from flooding in the short to medium term, with benefits to life, health and wellbeing. However, these risks will significantly increase in the time between reactive operations and in the medium to long term, particularly for the do minimum/maintain options. Additional potential stress compared to present due to lack of proactive management. • Maintenance of amenity beach and protection of coastal frontage with benefits to the tourism economy in the short to medium term; although potential risks/damage could increase in the medium to long term, depending on the level of intervention. • Reduction in risk to agricultural land would maintain productivity with benefits to the local economy in the short to medium term, although risks of flooding/losses would increase in the medium to long term. • Reduction in flood risk to roads and maintenance of access, with continued benefits to emergency services provision and community connectivity/viability, although risks of flooding/impacts would increase in the medium term. • Continued reduction in flood risk to features of archaeological and heritage value and the wider historic environment/seaside heritage along the frontage and within the hinterland. • Reduction in requirement for beach materials and associated reduced carbon footprint compared to present, but the longer term costs/footprint of damage and reconstruction would be significant. Requirements would be greater for the sustain option. • Limited opportunity to plan a robust adaptation strategy to account for future predicted climate change and except for the sustain option, does not provide a standard of protection that keeps pace with sea level rise and predicted changes. <u>Natural environment</u> • Continued reduction in flood risk to freshwater and terrestrial habitats and species within the hinterland – with risk increasing over time as beach levels decline
2.2	Maintain - doing the minimum works necessary - e.g. patch and repair + nourishment (open beach) as and when required, but excluding climate change.	Rejected due to a drop in standard of protection. Wave impacts and overtopping would progressive-ly increase.	
2.3	Sustain - doing the minimum works necessary - e.g. patch and repair + nourishment (open beach) as and when required, but keeping pace with climate change.	Rejected due to longer term drop in standard of protection. Wave impacts and overtopping would progressive-ly increase.	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
			between reactive nourishment operations or over time for maintain options. • Maintenance of existing beach and landward dune habitats and associated biodiversity, but eventual loss resulting in changes to subtidal habitats, physical processes and sediment transport. • Uncertain impacts on designated habitats and species and fisheries up and more likely downdrift. • Reduced requirement for supply of dredged sand from offshore sandbanks – avoids impact on benthic, subtidal and marine habitats and species in these areas. • Maintenance of existing hydromorphological pressure on the heavily modified coastal water body. In long term, saline flooding of hinterland could impact on groundwater body as a result of saline intrusion and impacts on artificial/heavily modified river water bodies that drain the area at risk. • Doing minimum patch and repair will allow deterioration of frontage over time resulting in adverse changes to landscape character and visual amenity. • Eventual loss of beach over time with potential changes in coastal morphology and potentially a more 'naturally' functioning coastline, but still significantly limited by the continued presence of the landward defences. Uncertain changes to southerly sediment transport. • Increased flood risk to geological features within the hinterland and exposure of designated geological features along the shoreline in the long term; including clay exposures known to be of paleo-environmental importance on the beach.
3	**Open beach – without control structures: (proactive beach management) options**		
3.1	Maintain - Beach without control structures, with present nourishment quantities.	Rejected due to medium and long term drop in standard of protection.	Population, economy and built environment • Continued reduction in risk to people and communities within low-lying areas at risk from flooding into the long term, with benefits to life, health and wellbeing, although these risks will increase over time for the maintain options, presenting some additional potential stress. • Continued maintenance of amenity beach and protection of coastal frontage with benefits to the tourism economy into the long term, depending on the level of intervention. Increased confidence for longer term business investment. • Continued reduction in risk to agricultural land to maintain productivity with benefits to the local economy
3.2	Sustain - Beach without control structures maintaining same standard of protection.	Identified as the preferred option in the short term on technical, economic and environment-tal criteria and a potential scenario in	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
		medium to long term. One of the options most favoured by stakeholders and the public.	into the long term, although these risks will increase over time for the maintain options. • Continued reduction in flood risk to roads and maintenance of access, with continued benefits to emergency services provision and community connectivity/viability, although these risks will increase over time for the maintain options. • Increasing issues relating to the movement of windblown sand as the height of the fronting beaches are increased over time. • Continued reduction in flood risk to features of archaeological and heritage value and the wider historic environment/seaside heritage along the frontage and within the hinterland, although these risks will increase over time for the maintain options. • Continued and increasing requirement for beach materials and associated increasing carbon footprint compared to present. Requirements would be greater for the sustain options. • Opportunity to plan a robust adaptation strategy to account for future predicted climate change and the sustain options provide a standard of protection that keep pace with sea level rise and predicted changes. <u>Natural environment</u> • Continued reduction in flood risk to freshwater and terrestrial habitats and species within the hinterland – with risk increasing gradually over time for maintain options relative to present. • Maintenance of existing beach and landward dune habitats and associated biodiversity; with uncertain changes as a result of options reducing the frequency of nourishment and the placement of larger volumes of material e.g. Option 3.5. • Uncertain impacts on designated habitats and species and fisheries up and more likely downdrift as a result of the continued losses of placed nourishmenrt material, in particular where nourishment frequency is reduced and increased volumes of material placed (e.g. Option 3.5). • Continued and increasing requirement for supply of dredged sand from offshore sandbanks – with impacts on benthic, subtidal and marine habitats and species in these areas. • Maintenance of existing hydromorphological pressure on the heavily modified coastal water body. Continued reduction in saline flooding of hinterland would benefit groundwater body and artificial/heavily modified river water bodies that drain the area at risk. • Retention of existing landscape character of a shoreline with a sandy beach and open views along the coast and
3.3	Maintain - Beach without control structures changing nourishment frequency to every 2 or 3 years.	<u>Rejected</u> due to unacceptable risk of a lower standard of protection in intermediate years in an open beach approach and long term drop in standard of protection.	
3.4	Sustain - Beach without control structures changing nourishment frequency to every 2 or 3 years.	<u>Rejected</u> due to unacceptable risk of a lower standard of protection in intermediate years in an open beach approach.	
3.5	Sustain - Beach without control structures change nourishment frequency to more than 5 years (e.g. sand engine).	<u>Rejected</u> due to unacceptable risk of a lower standard of protection in intermediate years in an open beach approach.	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
			seaward. Uncertain changes as a result of options reducing the frequency of options e.g. Option 3.5. • Maintain/sustain options will vary the degree of nourishment required. Potential implications for sediment transport and coastal processes relative to present conditions. Uncertain changes to southerly sediment transport. • Continued reduction in flood risk to geological features within the hinterland and protection of designated geological features along the shoreline in the long term; including clay exposures known to be of paleo-environmental importance on the beach.
3.6	Maintain - Beach without control structures with different beach material grading.	Rejected due to distance to source of material and unpopularity of material with stakeholders and the public and the long term drop in standard of protection.	Population, economy and built environment Similar to the other open beach options (3.1 - 3.5) except: • Reduced requirement for beach materials and associated reduced carbon footprint compared to present. Requirements would be greater for the sustain options. • Potential perceived reduction in attractiveness of beach to visitors and tourists, with associated adverse impacts on the local tourism economy. • Importation of material required as no local sources likely to be available.
3.7	Sustain - Beach without control structures with different beach material grading.	Rejected due to distance to source of material and unpopularity of material with stakeholders and the public.	Natural environment Similar to the other open beach options (3.1 - 3.5) except: • Maintenance of existing beach and landward dune habitats and associated biodiversity. However, the ecology of the beach itself and the inter/subtidal area will be altered from present conditions with the use of an alternative material. Level and type of impact is unknown. • Uncertain impacts on designated habitats and species and fisheries up and more likely downdrift as a result of the reduced losses of placed nourishment material. • No requirement for supply of dredged sand from offshore sandbanks – with impacts on benthic, subtidal and marine habitats and species in these areas. • Change in existing landscape character of shoreline from a sandy to a stony beach. • Potential implications for sediment transport and coastal processes relative to present conditions.
3.8	Maintain - Beach without control structures with different standards of protection in	Rejected due to option not favoured by stakeholders.	Population, economy and built environment Similar to the other open beach options (3.1 - 3.5) except: • Potential reduced requirement for beach materials and associated reduced carbon footprint compared to

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
	different areas.		present. Requirements would be greater for the sustain options. • Option would require increase in resilience for structures which would be susceptible to more overtopping. <u>Natural environment</u> Similar to the other open beach options (3.1 - 3.5) except: • Maintenance of existing beach and landward dune habitats and associated biodiversity in key sensitive locations except where standards of protection are reduced. Potential opportunities to align any reduction in standards of protection with initiatives to create habitats more tolerant of occasional flooding. • Reduced requirement for supply of dredged sand from offshore sandbanks relative to present – with reduced impacts on benthic, subtidal and marine habitats and species in these areas.
3	**Introduction of control structures (with proactive beach management)**		
3.9	Maintain - Beach with detached offshore rock armour control structures with some areas maintaining same standard of protection.	<u>Rejected</u> due to the long term drop in standard of protection and the option not favoured by stakeholders and the public.	<u>Population, economy and built environment</u> • Continued reduction in risk to people and communities within low-lying areas at risk from flooding into the long term, with benefits to life, health and wellbeing, although these risks will increase over time for the maintain options, presenting some additional potential stress. • Continued maintenance of amenity beach and protection of coastal frontage with benefits to the tourism economy into the long term, depending on the level of intervention. Increased confidence for longer term business investment. • Presence of structures will alter beach form and the potential use of the beach and access opportunities, particularly at higer states of tide. • Continued reduction in risk to agricultural land to maintain productivity with benefits to the local economy into the long term, although these risks will increase over time for the maintain options. • Continued reduction in flood risk to roads and maintenance of access, with continued benefits to emergency services provision and community connectivity/viability, although these risks will increase over time for the maintain options. • Continued reduction in flood risk to features of archaeological and heritage value and the wider historic environment/seaside heritage along the frontage and within the hinterland, although these risks will increase over time for the maintain options. Presence of new significant subtidal structures could result in loss of/damage to clay exposures/any unknown areas of
3.10	Sustain - Beach with large rock armour fishtail breakwater control structures maintaining same standard of protection.	<u>Rejected</u> due to just being edged out of the top six at detailed assessment. However, in some locations fishtail breakwaters could be used in combination with groyne structures in the medium to long term.	
3.11	Sustain - Beach with rock armour	Identified as a <u>potential scenario</u> (and	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
	groynes structures maintaining same standard of protection.	preferred approach) in some locations and also in combination with other structures in the medium to long term. One of the options most favoured by stakeholders and the public.	archaeological interest under footprint of new beach and submerged structures; with greater impacts for options that have the largest physical footprint or potentially alter the seaside heritage and character of the frontage. • Initial significant requirement to source construction materials (rock, timber) to build new defence structures – potential types of materials and sources not yet known – and ongoing management to maintain/sustain existing standard of protection. • Reduced requirement for nourishment materials and associated reduced carbon footprint compared to present. Requirements would be greater for the sustain options. The exception to this is timber groynes, which would not work and would require significant additional nourishment material. • Opportunity to plan a robust adaptation strategy to account for future predicted climate change and the sustain options provide a standard of protection that keep pace with sea level rise and predicted changes. Natural environment • Continued reduction in flood risk to freshwater and terrestrial habitats and species within the hinterland – with risk increasing gradually over time for maintain options relative to present. • Maintenance of existing beach and landward dune habitats and associated biodiversity; with uncertain changes as a result of the introduction of new structures. Opportunity to design new structures to increase biodiversity potential. • Uncertain impacts on designated habitats and species and fisheries up and more likely downdrift as a result of the reduced losses of placed nourishmenrt material. • Continued, but reduced relative to present, requirement for supply of dredged sand from offshore sandbanks – with impacts on benthic, subtidal and marine habitats and species in these areas. • Maintenance of existing and introduction of new hydromorphological pressure on the heavily modified coastal water body. Continued reduction in saline flooding of hinterland would benefit groundwater body and artificial/heavily modified river water bodies that drain the area at risk. • Introduction of large rock structures, breakwaters and fish tail groynes will invariably affect the landscape and visual amenity, changing the existing character of the coastline and views from the beach/frontage; • Introduction of new structures will change the local shoreline processes and sediment movement – depending on the type, size, position and location of
3.12	Sustain - Beach with timber groynes structures maintaining same standard of protection.	Rejected due to the failure of this type of structure in the past and the structural issue with the scale of the beach height retention required to sustain the standard of protection.	
3.13	Sustain - Beach with rock armour structure combinations maintaining same standard of protection.	Identified as potential scenario (and preferred approach) in medium to long term. One of the options most favoured by stakeholders and the public.	
3.14	Sustain - Beach with rock armour structures allowing for change in nourishment volume.	Rejected as option not favoured by stakeholders and the public.	
3.15	Sustain - Beach with rock armour structures	Rejected as option not favoured by	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
	allowing for change in nourishment frequency.	stakeholders and the public.	structures; and associated beach nourishment. These could have potential wider implications for sediment transport and coastal processes relative to present conditions. • Continued reduction in flood risk to geological features within the hinterland and protection of designated geological features along the shoreline in the long term; including clay exposures known to be of paleo-environmental importance on the beach. However, presence of new significant subtidal structures result in loss of/damage to clay exposures/any unknown areas of archaeological interest under footprint of new beach and submerged structures and geological features along the shoreline.
3.16	Maintain - Beach with rock armour structures allowing for nourishment volumes/frequencies giving lower (or higher if sustain & improve) SoP.	Rejected due to the long term drop in standard of protection.	
4	**Seawalls only, no beach: options**		
4.1	Maintain – maintaining and repairing seawalls only.	Rejected due to the long term drop in standard of protection and change in amenity.	Population, economy and built environment • Continued reduction in risk to people and communities within low-lying areas at risk from flooding into the long term, with benefits to life, health and wellbeing, although these risks will increase over time for the maintain options, presenting some additional potential stress. • Loss of amenity beach and protection of coastal frontage with significant adverse impacts on the tourism economy in the medium to long term. Reduced confidence for longer term business investment. • Continued reduction in risk to agricultural land to maintain productivity with benefits to the local economy into the long term, although these risks will increase over time for the maintain options. • Continued reduction in flood risk to roads and maintenance of access, with continued benefits to emergency services provision and community connectivity/viability, although these risks will increase over time for the maintain options. • Continued reduction in flood risk to features of archaeological and heritage value and the wider historic environment/seaside heritage along the frontage and within the hinterland, although these risks will increase over time for the maintain options. Presence of new larger seawalls could affect the seaside heritage and any heritage assets. The erosion of the beach will result in the loss of/damage to clay exposures/any unknown areas of archaeological interest. • Initial requirement to source construction materials to increase defence structures – potential types of materials and sources not yet known – and ongoing management to maintain/sustain existing standard of protection.
4.2	Sustain – raising seawalls only.	Rejected due to the change in amenity and costs and also due to the option not favoured by stakeholders.	
4.3	Sustain - widening seawalls only.	Rejected due to the change in amenity and costs and also due to the option not favoured by stakeholders.	
4.4	Sustain, maintain or do minimum, repair, raise or widen seawalls with no beach nourishment.	Rejected due to the change in amenity and costs and also due to the option not favoured by stakeholders.	

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
			• Reduced requirement for nourishment materials and associated reduced carbon footprint compared to present. • Opportunity to plan a robust adaptation strategy to account for future predicted climate change and the sustain options provide a standard of protection that keep pace with sea level rise and predicted changes. <u>Natural environment</u> • Continued reduction in flood risk to freshwater and terrestrial habitats and species within the hinterland – with risk increasing gradually over time for do minimum/maintain options relative to present. • Loss of existing beach and effects on associated dune habitats and associated biodiversity. Likely changes in subtidal habitats (*Sabellaria* potentially present), physical processes and sediment transport up and downdrift (from present day). • Uncertain impacts on designated habitats and species and fisheries up and more likely downdrift as a result of the changes to beach dynamics. • No requirement for supply of dredged sand from offshore sandbanks – with benefits to benthic, subtidal and marine habitats and species in these areas. • Maintenance of existing and introduction of increased hydromorphological pressure on the heavily modified coastal water body. Continued reduction in saline flooding of hinterland would benefit groundwater body and artificial/heavily modified river water bodies that drain the area at risk. • Options with seawall repairs and improvements (i.e. raising or widening) without beach nourishment would be very detrimental to the landscape (especially the seascape) and visual amenity would be severely affected. • Introduction of new structures will change the local shoreline processes and sediment movement – depending on the type, size, position and location of structures; and associated beach nourishment. These could have potential wider implications for sediment transport and coastal processes relative to present conditions. • Continued reduction in flood risk to geological features within the hinterland. However, the loss of the beach would reduce protection to and erode the designated geological features along the shoreline; including clay exposures known to be of paleo-environmental importance on the beach.
5	**Compartmentalisation options [hardpoints with or without coastal realignment]**		

Approach (Ref)	Option description	Status/why rejected?	Key environmental consequences
5.1	Sustain - Various approaches, e.g. rock headlands and wider beaches.	Rejected due to the overall low score in the detailed assessment, although there are potential environmental opportunities.	Population, economy and built environment Similar to the other control structure options (3.9 - 3.16) except: • Even greater potential of reduced requirement for beach materials and associated reduced carbon footprint compared to present. Requirements would be greater for the sustain options. • High potential for development surrounding new headlands but existing developments may suffer. • Continued reduction in flood risk to features of archaeological and heritage value and the wider historic environment/seaside heritage along the frontage and within the hinterland within the compartments/potential realignment areas. No changes from present for sustain options and no differences between options. Natural environment Similar to the other control structure options (3.9 - 3.16) except: • Maintenance of existing beach and landward dune habitats and associated biodiversity – with the flexibility to consider realignment and alternative, more diverse, habitat creation as appropriate. • Reduced requirement for supply of dredged sand from offshore sandbanks relative to present – with reduced impacts on benthic, subtidal and marine habitats and species in these areas. • Provide opportunities to create more stable beach environment and associated biodiversity. • Potential opportunities to create sections of more 'naturally' functioning coastline within any realignment areas. • May be beneficial in landscape and amenity respects in some areas but detrimental in others, i.e. depends very much on where the new features are introduced and how the coastal processes respond. • Changes to the local shoreline processes and sediment movement – depending on the type, size, position and location of structures; and associated initial beach nourishment.
5.2	Sustain - Hardpoints plus single realignment and beaches in some locations.	Rejected due to the overall low score in the detailed assessment, although there are potential environmental opportunities.	
5.3	Sustain - Hardpoints plus multiple realignment and beaches in some locations.	Rejected due to the overall low score in the detailed assessment, although there are potential environmental opportunities.	

8. Conclusions, recommendations and next steps

8.1 Conclusions and recommendations

The proposed strategy comprises a combination of short, medium and long-term proposals to manage coastal flood risks along the low-lying coastline between Saltfleet and Gibraltar Point, through an adaptive approach over the next 100 years. The strategy is needed to manage the risk of tidal flooding, particularly as climate change and sea level rise are predicted to increase these risks in the future.

This ER presents the results of an SEA undertaken in accordance with the SEA Regulations. This assessment has identified that the strategy will result in the following **significant** (i.e. those impacts scoring **++** or **XX**) and **uncertain** (**?**) impacts. Many other minor positive (**+**) and negative (**-**) effects have been identified, which are documented within this SEA ER.

Mitigation measures are proposed for all negative and uncertain effects identified, whether significant or minor. Key actions identified to avoid or reduce the negative 'significant' impacts are provided in the mitigation recommendations in Section 6.

Table 8.1: Summary of identified significant or uncertain effects

Population, health and economy	
• The present level of flood protection will be sustained, in line with predicted climate change, to people, up to 22,000 houses and commercial properties, 24,500 seasonally occupied static caravans and areas of employment in all coastal zones, with associated benefits to health and well-being in the short to long-term. These impacts will benefit areas of social deprivation and vulnerable members of the community.	**++**
• Increased confidence that the level of flood protection provided in the medium to long-term will be effective, which will help attract economic investment in the floodplain (scenario 2 only).	**++**
• Protection of the high value amenity beaches, beachside facilities, holiday accommodation and continued unrestricted access (including the England Coast Path) along the coast in the short to long-term (except the beach in the medium to long-term under scenario 2).	**++**
• Continued attractiveness of the coastal frontage to visitors and tourists with associated benefits to the economy at the seaside resorts of Mablethorpe, Trusthorpe, Sutton-on-Sea, Sandilands, Chapel St Leonards, Ingoldmells and Skegness in the short to long-term.	**++**
• Potential disruption in short, medium and long-term to fisheries (e.g. brown shrimp in The Wash) by limiting access to beach launching sites and nearshore fishing grounds during works. Uncertain potential changes to fish yields due to the loss of nourishment material from the frontage in the medium to long term (scenario 1). The introduction of new structures in the medium to long-term (scenario 2) could present a new hazard to navigation for fishing boats. Further assessment will be required.	**X/?**
Material assets	
• The present level of flood protection will be sustained, in line with predicted climate change, to all strategic A-roads and local roads within the tidal floodplain in the short to long-term.	**++**
• The present level of flood protection will be sustained, in line with predicted climate change, to critical infrastructure and services (power, water, wastewater) in the short to long-term.	**++**

• Reliance on annual sourcing, use and redistribution of large volumes of sand for beach nourishment and replenishment of losses in the medium to long term (under scenario 1). The design and development of the beach nourishment programme will need to be carefully considered to minimise the volume of materials required.	**XX**
Wildlife and biodiversity	
• The present level of flood protection will be sustained, in line with predicted climate change, to terrestrial and freshwater habitats including those within the designated conservation sites within tidal floodplain (e.g. Sea Bank Clay Pits SSSI) in the short to long-term.	**++**
• Potential for some uncertain or negative effects on European or internationally designated conservation sites in the short, medium and long term. The Stage 2 HRA concluded that, with the implementation of appropriate mitigation and monitoring, the Strategy will not adversely affect the integrity of any of these sites. Further scheme-level HRA will be required.	**X/?**
• Potential accretion of nourishment sand downdrift e.g. in The Wash. This has potential to impact on fisheries in the short to long-term under scenario 1. The installation of new structures (scenario 2) has potential for indirect effects on fisheries/shellfisheries further south in medium to long-term. Further assessment and continued monitoring is needed to better understand future changes.	**X/?**
Soils, geology and geomorphology	
• Continued protection through increased sand or sediment cover of geological deposits (though degree of coverage will vary) in short to long-term (under scenario 1).	**++**
• The present level of flood protection will be sustained, in line with predicted climate change, to soils and potential polluting sites (e.g. landfills) within wider floodplain in short to long-term.	**++**
Land use	
• The present level of flood protection will be sustained, in line with predicted climate change, to 21,000 ha of moderate to high quality agricultural land in short to long-term.	**++**
• The present level of flood protection will be sustained, in line with predicted climate change, to all land uses in the tidal floodplain, maintaining habitability and use of the urban areas in the short to long-term.	**++**
Climate	
• The proposals will enable adaptation to future changes in climate and sea level rise in the short to medium term.	**++**
• Continued beach nourishment in the medium to long term will result in increasing carbon generation to sustain flood protection. Measures to reduce the amount of carbon dioxide released into the atmosphere resulting from on-going maintenance, material sourcing and defence raising, and the construction of new structures (for scenario 2) will be required.	**XX**
Historic environment	
• Continued protection of heritage assets and the historic landscape behind defences in short to long-term.	**++**
• Non-designated archaeological/plaeoenvironmental features present on the foreshore would continue to be buried under sandy beaches.	**++**
Landscape and views	
• Beach nourishment would protect the coastal landscape and views of beaches in the medium to long term (under scenario 1) and maintain the landscape behind the defences (both scenario 1 and 2).	**++**
• New and increasing numbers of large rock structures in the medium to long-term (scenario 2) will cross the open beach and change landscape/seascape. Dependent on their form and location, the new structures may adversely alter the rural character of the	**XX**

coastline between Donna Nock and Gibraltar Point. These impacts will need to be managed through designing defences, where possible, that complement the geometry of the coast and that consider the interface with the natural beach with a gradual change in rock size.	

The actions and proposed mitigation measures set out throughout the SEA ER will be reviewed and assessed as the strategy is implemented over time and design details (e.g. visual appearance, siting and footprint of structures etc.), as well as an improved understanding of coastal processes, become available. Additional monitoring will be required to ensure that mitigation measures are appropriate.

This assessment also considered the potential effects of the proposed strategy in combination with other key plans and strategies either in place or in development; details of which are provided in Section 3.4. This brief assessment identifies that the proposed strategy is generally compatible with the plans and strategies considered, taking into account their requirements. Further studies will be required at scheme design stage, which may include modelling of impacts, to ensure that no adverse in-combination effects result from the proposed works to implement the strategy. The key recommendation from this assessment is to continue liaison with the statutory bodies and organisations implementing/promoting the other plans to ensure that any potential interfaces/conflicts can be managed and opportunities for efficiencies and additional benefits can be delivered.

The following opportunities/potential benefits are recommended to be taken forward for further consideration as the strategy is implemented:

- Raise awareness of the continued flood protection afforded by strategy implementation, which will provide improved confidence for investment (particularly in the medium and long-term) by other parties and facilitate present and future economic development in the floodplain, as well as opportunities for future development of nature tourism.
- If larger structures are constructed in the medium to long-term under scenario 2, seek to create more sheltered conditions for beach use, with more defined spaces and conditions at popular beaches.
- Plan and design the integration of any new future infrastructure with any proposed new rock structures under scenario 2, in consultation with infrastructure providers.
- Plant marram grass to establish pioneer dunes along the beach, in consultation with environmental stakeholders.
- Design any new rock structures under scenario 2, to provide new habitat for colonisation by marine invertebrates.
- Further assess the siting of any proposed structures under scenario 2 to identify opportunities for enhancement to the historic environment.
- Enhance and stabilise landscape habitats in dune areas and earthbanks through beach nourishment, where possible, to maximise the coastline habitats and help enhance the characteristic landscape features of the coastline.
- Improve the habitat and landscape/visual connectivity between inland areas and the coast and create greater species diversity, greater visual diversity and improved scenic quality over time by planting areas of dunes or earthbanks, which remain unchanged through the beach nourishment process.
- Seek to deliver additional benefits in combination with other plans and local initiatives, including the adopted East Lindsey Local Plan, the Anglian FRMP and RBMP, the

Greater Lincolnshire Coastal Vision, Wild Coast Vision and Coastal Country Park, and other strategic developments.

A key recommendation for the implementation of the draft strategy is that the medium and long-term interventions will depend on continued monitoring of the environmental effects, and subsequent review. The SEA ER provides a monitoring plan for the significant effects of the strategy taking into consideration the SEA assessment criteria and associated indicators and targets. This monitoring plan will allow the comparison of predicted effects with actual monitored effects.

Key recommendations of the proposed monitoring that has been identified to inform strategy delivery are summarised below:

- Annual monitoring of beach profiles in sensitive locations and areas susceptible to windblown sand. This will enable reprofiling of the beach if nourishment exacerbates management issues associated with wind blown sand that restrict access along the promenade walkway/cycleways, and to develop a plan, as part of project delivery, to manage public access. This can also be used to review the depth of protection and degree of exposure of geological features from nourishment and placement of rock to enable action, if needed. Monitoring of beach profiles will also help understand geomorphological changes along the coast and downdrift.
- Monitoring of geomorphological change and offshore processes - to improve understanding of the implications of sourcing, removal and redistribution of recharge material within the sediment system, and effects on coastal morphology.
- Review of bathing waters monitoring data – to ensure nourishment does not affect bathing water quality or fisheries.
- Continue existing reviews of fishing data and monitoring regime at commercial (shell) fishery locations to assess changes in fishing yields within nearshore waters and status of commercial fisheries. Modelling of potential physical geomorphological changes and associated effects on fisheries during and post strategy implementation.
- Review existing WFD monitoring data for relevant waterbodies – to ensure WFD objectives are not compromised during strategy implementation.
- Review levels of carbon emissions proposed by individual projects during implementation of the strategy – to identify ways to reduce carbon footprint of schemes.
- Ongoing discussion is recommended with:
    - ELDC and LCC – to monitor wind-blown sand on local roads and maintain safe access.
    - infrastructure providers (including TKES and managers of Viking Link) – to avoid in-combination impacts on the environment associated with cable landings/drainage outfalls and the proposed nourishment activities.
    - Natural England and RSPB – to obtain existing and ongoing monitoring data of habitat types, extent and distribution within the Gibraltar Point complex to improve our understanding of habitat change.
    - Lincolnshire Wildlife Trust – to obtain survey data for habitats and species of conservation concern from existing monitoring regimes.

The recommendations of the draft strategy and the SEA Environmental Report have been informed by extensive stakeholder and public engagement activities. These will be subject to formal consultation in summer 2019 to seek the views of stakeholders and the general public.

Following completion of the formal consultation, all responses will be reviewed and any actions/changes required considered and undertaken (see Section 8.4).

8.2 Related assessments

8.2.1 Habitats Regulations Assessment

A Habitat Regulations Assessment was undertaken, as required by the Habitats Regulations 2017 (Appendix A). The initial Stage 1 screening assessment concluded that the strategy would have likely significant effects on some qualifying features within the following European sites, alone and/or in-combination:

- Saltfleetby-Theddlethorpe Dunes and Gibraltar Point SAC in the medium and long-term (both scenarios).
- Gibraltar Point SPA and Ramsar site in the medium and long-term (both scenarios).
- The Wash and North Norfolk Coast SAC in all time periods (both scenarios).
- The Wash SPA and Ramsar site in all time periods (both scenarios).
- Inner Dowsing, Race Bank and North Ridge Offshore SAC in the medium and long-term (both scenarios).

Therefore, an Appropriate Assessment was undertaken of the implications of the proposal in view of the sites' conservation objectives. The Appropriate Assessment concluded that based on the current understanding of the strategy proposals and knowledge of the European sites within and adjacent to the strategy area, the strategy will not adversely affect the integrity of any European sites, subject to the implementation of appropriate mitigation and monitoring to resolve any residual areas of uncertainty.

8.2.2 Water Framework Directive compliance

A separate WFD assessment has been prepared to assess the compliance of the strategy proposals in terms of the WFD objectives and requirements (Appendix B). Consideration of potential impacts/compliance has also been incorporated within the SEA objectives and included within the assessment presented within this ER.

The WFD assessment identified the following impacts:

- Continued impact on coastal water bodies, due to the redistribution of nourishment sediments offshore and southwards, with potential effects on intertidal and subtidal habitats within the Lincolnshire and Wash (Outer and Inner) water bodies. The installation of structures will reduce the movement of sediment and will therefore have a different (possibly reduced) impact on downdrift habitats; this will need to be informed by scheme design.
- Sustaining the present level of flood protection in line with predicted climate change will continue to manage the risk of saline intrusion to inland water bodies.
- Potential for sediment to block outfalls under both Scenario 1 and 2, and management of this will be required. There is scope for incorporating the outfalls within the structures as part of implementing scenario 2, which could address this issue and minimise maintenance requirements.
- Construction of structures will have a negative impact on shoreline habitats and benthic invertebrates due to their physical footprint. However, there is potential for the structures to act like a reef and attract colonisation of macroalgaes and invertebrates within the gaps between the rock, with potential for habitat gain and possible improvement in water body status (Lincolnshire water body).

The WFD assessment concluded that all the draft proposals/scenarios put forward as part of the strategy are not predicted to cause deterioration in water body status or prevent any water body from meeting its objectives and therefore an assessment against the conditions listed in Article 4.7 is not required at this strategy level.

8.3 Next steps in the SEA process

This SEA Environmental Report has been prepared to support the consultation on the proposed strategy with the SEA consultation bodies, stakeholders and the general public. All comments received on this report will be considered and, where required, addressed prior to the seeking of technical and funding approval for the strategy.

A post-adoption statement will be published advising where the public can view the adopted plan, its Environmental Report, and the Statement of Environmental Particulars. The Statement of Environmental Particulars will document:

- How environmental considerations have been integrated into the plan;
- How the environmental report and consultation responses have been taken into account;
- The reasons for choosing the strategy as adopted in light of other reasonable alternatives considered by the SEA; and
- The measures to be taken to monitor the significant environmental effects of implementing the strategy.

On implementation of the actions recommended in the strategy in the short term, the recommended mitigation and monitoring proposals will be put in place to ensure that the SEA influences the future implementation of the strategy to minimise adverse effects and maximise opportunities for environmental enhancements.

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GLOSSARY OF TERMS

— A —

Advance the line
The construction of a new flood management scheme in front of existing flood defences.

Agri-environment schemes
Schemes under EC Regulation 1257/99, which offer grants for measures to conserve and enhance the countryside.

Annual Excedence Probability (AEP)
The probability of a flood event within any given year e.g. 1% AEP is equal to a 1 in 100 probability of occurance.

Air Quality Management Area (AQMA)
An area which has been identified by local authority to be unable to meet its air quality targets and as such has specific targets and actions set in order to meet these objectives.

Area of Outstanding Natural Beauty (AONB)
AONBs were formally designated under the National Parks and Access to the Countryside Act of 1949 to protect areas of the countryside of high scenic quality that cannot be selected for National Park status owing to their lack of opportunities for outdoor recreation (an essential objective of National Parks). Further information on AONBs can be found at: http://www.aonb.org.uk

— B —

Beach Nourishment
The process of importing sand material to a beach location to maintain its volume and mitigatge against beach erosion.

Biodiversity Action Plan (BAP)
An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity. BAPs are statutory documents. For further information, consult the BAP website: http://www.ukbap.org.uk

Birds Directive
European Community Directive (79/409/EEC) on the conservation of wild birds. Implemented in the UK as the Conservation (Natural Habitats, etc.) Regulations (1994). For further information, consult Her Majesty's Stationary Office (HMSO) website: http://www.hmso.gov.uk/si/si1994/Uksi_19942716_en_1.htm

— C —

Catchment
The area drained by a particular river or watercourse. A surface water catchment is the area defined by the highest boundary between two catchments whilst a groundwater catchment is the area that contributes to the groundwater component of the river flow.

Catchment Flood Management Plan (CFMP)
A CFMP is a large scale, long-term (50 to 100 years) strategic planning framework for the integrated management of flood risks to people and the developed and natural environment in a sustainable manner.

Cefas
This is the UK Government's Centre for Environment, Fisheries, and Aquaculture Science and are involved in ensuring seafood is sustainably produced and supporting sustainable development of the aquaculture industries.

Countryside Character Areas
Non-statutory sub-divisions of England, as defined under the former Countryside Agency's Countryside Character Initiative. There are 159 Character Areas in England, each with a broadly cohesive countryside character and specific ecological and landscape issues.

— D —

Defra
Department for Environment, Food and Rural Affairs. The department of central Government responsible for flood management policy in England.

— E —

Environment Agency
Non-departmental public body responsible for the delivery of UK Government policy relating to the environment and flood risk management in England and Wales.

Environmental Impact Assessment (EIA)
The process by which the likely impacts of a project or development upon the environment are identified and assessed to determine their significance. EIA is statutory for many developments likely to have a significant environmental impact.

— F —

Flood Defence
A structure (or system of structures) for the alleviation of flooding from rivers or the sea. Flood defences only reduce the likelihood of flooding and not the consequences of flooding when they are overtopped. Flood risk is a combination of likelihood of the flood occurring and the consequences when it does.

Flood Risk
Flood risk is the product of the likelihood (or frequency) of floods and their consequences (such as property loss or damage, physical harm or distress and social and economic disruption).

Flood Risk Management
Changing the frequency or consequences of flooding to an appropriate level (appropriate to land use), and monitoring to make sure that flood risks remain at this level. This should take account of other needs to manage water levels, and opportunities and constraints. It is not just about applying flood defence measures.

Flood and Coastal Risk Management Strategy (FCRMS)
A long-term approach to developing and setting out the policy, objectives and responses to flood and coastal management taking into account a broad range of local, national and international issues.

— G —

Geomorphology
Geomorphology is concerned with the structure, origin and development of the topographical features of the earth's crust.
Groundwater

Water occurring below ground in natural formations (typically rocks, gravels and sands). The subsurface water in the zone of saturation, including water below the water table and water occupying cavities, pores and openings in underlying soils and rocks.

— H —

Habitats Directive
European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna, as amended. Implemented in the UK through the Conservation of Habitats and Species Regulations (2017) and known as the 'Habitats Directive'. It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance. For details of the transposing UK regulations, refer to http://www.legislation.gov.uk/uksi/2017/1012/contents/made.

Habitats Regulations Assessment (HRA)
An assessment of potential impacts on flora and fauna protected by the Habitats Directive.

Historic Environment
Encompassing all elements of designated or un-designated archaeological sites, historic buildings and historic landscapes. It also includes sites of palaeo-environmental interest that provide information about the nature of past landscapes, climate and environments.

Hold the line
Maintaining the existing flood defences and control structures in their present positions and increase the standard of protection against flooding in some areas.

— I —

Indicative Standard of Protection
The range of level of protection to be considered for flood defences, based upon the use of the land being protected. They do not represent any entitlement to protection or minimum level to be achieved.

— L —

Land Use
The use to which an area of land is put (e.g. residential, agriculture, forestry, etc.). The term Land Use is used in many contexts and is controlled by the town and country planning system.

Local Development Documents
These are statutory plans providing information used to decide planning applications for land use development in England. The system currently consists of Local Plans produced by District Councils and Unitary Authorities.

— M —

Managed realignment
The policy of managed realignment involves the placement of a new managed Realignment flood defence landward of the existing flood defences or realignment to higher ground. This policy would be achieved through the partial or complete removal of the existing flood defences or through regulated tidal exchange.

— N —

National Nature Reserve (NNR)
National Nature Reserves are designated under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981 (as amended) primarily or nature conservation, but can also include sites with special geological or physical features.

They were established to protect the most important areas of wildlife habitat and geological formations in Britain, and as places for scientific research.

Natura 2000 Network
European network of protected sites which represent areas of the highest value for natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. The Natura 2000 network includes Special Areas of Conservation (SAC) or Sites of Community Importance (SCI) where they support rare, endangered or vulnerable natural habitats and species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs and SCIs are designated under the Habitats Directive and SPAs are classified under the Birds Directive.

Natural England
Natural England works for people, places and nature, to enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas; promoting access, recreation and public well-being, and contributing to the way natural resources in England are managed so that they can be enjoyed now and in the future. For further information refer to the Natural England website: www.natural-england.org.uk

No active intervention
This refers to a policy whereby there would be no further management intervention. Also referred to as 'Do Nothing'. Without intervention the defences would eventually fail and areas currently protected from flooding would no longer be protected. This would happen gradually over a long period of time. However, land owners may be entitled to pay for the continued maintenance of the flood defences or undertake maintenance themselves following the preparation of an Exit Strategy.

— O —

— P —

Partnership Funding Calculator
The partnership funding calculator determines how much flood and coastal erosion risk management grant in aid a project is eligible for. All risk management authorities need to use this to determine how much partnership contributions will be required towards an FCRM project.

— Q —

— R —

Ramsar site
The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat (1971) requires the UK Government to promote using wetlands wisely and to protect wetlands of international importance. This includes the designation of certain areas as Ramsar sites, where their importance for nature conservation (especially with respect to waterfowl) and environmental sustainability meet certain criteria. Ramsar sites receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended).Further information can be located on the RAMSAR convention on wetlands website: http://www.natural-england.org.uk/ourwork/conservation/designatedareas/ramsars/default.aspx

Receptor
Asset, people or environmental, cultural or landscape resource that is at risk of flooding or potentially affected by the implementation of the strategy.

Registered Historic Parks and Gardens
Historic England maintains a Register of Parks and Gardens of special historic interest in England. The register seeks to ensure that the features and qualities that make these landscapes of national importance are safeguarded but does not give extra protection.

River Basin Management Plan
Part of the Water Framework Directive (WFD), these plans describe the unique characteristics of each river basin, and the pressures it faces from pollution and over-use. The plans set out a programme of measures for each river basin, which set out how the WFD objectives can be achieved.

— S —

Scheduled Monuments (SM)
To protect archaeological sites for future generations, the most valuable sites may be "scheduled". Scheduling means nationally important sites and monuments are protected by law by being placed on a list, or 'schedule'. Further information can be found on the Historic England (www.historicengland.org.uk) website.

Sea level change
The rise and fall of sea levels throughout time in response to global climate and local tectonic changes.

Sedimentation
The process of depositing sediment.

Shoreline Management Plan (SMP)
Non-statutory high level plans to provide sustainable coastal management policies (to prevent erosion by the sea and flooding of low-lying coastal land), and to set objectives for managing the shoreline over 100 years. These are prepared by us or maritime local authorities, individually or as part of coastal defence groups.

Site of Special Scientific Interest (SSSI)
Sites notified under the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way (CRoW) Act 2000) for their flora, fauna, geological or physiographical features. Notification of a SSSI includes a list of activities that may be harmful to the special interest of the site. Section 28 of the Wildlife and Countryside Act 1981 (provisions relating to SSSIs) has been replaced by a new Section 28 in Schedule 9 of the CRoW Act. The new Section 28 provides significantly improved protection for SSSIs. All SACs, SCIs, SPAs and Ramsar sites are designated as SSSIs. For further information, refer to Natural England's website: http://www.natural-england.org.uk/ourwork/conservation/designatedareas/sssi/default.aspx

Special Area for Conservation (SAC)
An internationally important site for habitats and/or species, designated as required under the European Community 'Habitats Directive' (92/43/EEC). SACs are protected for their internationally important habitat and non-bird species. SACs also receive SSSI designation under The Countryside and Rights of Way (CRoW) Act (2000) and The Wildlife and Countryside Act (1981) (as amended). For further details refer to the Joint Nature Conservation Committee website:
http://www.jncc.gov.uk/ProtectedSites/SACselection/UK_SAC_map.htm

Special Protection Area (SPA)
A site of international importance for birds, designated as required by the EC Birds Directive. The Government has to consider the conservation of SPAs in all its planning decisions. SPAs receive SSSI designation under The Countryside and Rights of Way (CRoW) Act 2000 and The Wildlife and Countryside Act 1981 (as amended). For further details refer to the European Commission website:

http://europa.eu.int/comm/environment/nature/spa/intro_en.pdf and The Joint Nature Conservation Committee website at: http://www.jncc.gov.uk/ukspa/sites/spalistA-C.htm

Stakeholder Engagement Plan
A plan that sets out the consultation programme, and specific arrangements for consulting both internal teams and external organisations.

Standard of Protection (SoP)
The standard of flood defence afforded to a location or community, expressed as the chance of a flood causing flooding to an area or overtopping of defences. A SoP of 0.1% (1 in 1000 chance of occurrence in any given year) means that the location will not flood until this or greater floods occur.

— T —

— U —

— W —

Watercourses
Water features include rivers, lakes, ponds, canals and coastal waters.

Water Framework Directive (WFD)
European Community Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on: ecological and chemical measures; common monitoring and assessment strategies; arrangements for river basin administration and planning; and a programme of measures to meet the objectives. For further details consult the European Commission website: http://europa.eu.int

Wildlife and Countryside Act 1981 (as amended)
The principal mechanism for the legislative protection for wildlife in Great Britain. This legislation is the means by which the EC Habitats Directive and EC Birds Directive are implemented in Britain.

APPENDICES

A Habitats Regulations Assessment
- Stage 1 Likely significance test
- Stage 2 Appropriate assessment

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