

Humber Estuary Coastal Authorities Group **Flamborough Head to Gibraltar Point Shoreline Management Plan**

Appendix L - Habitat Regulations Assessment Incorporating a Report to Inform an Appropriate Assessment

Final

December 2010



Prepared for
Humber Estuary Coastal Authorities Group

Revision Schedule

Flamborough Head to Gibraltar Point Shoreline Management Plan

Appendix L - Habitat Regulations Assessment incorporating a report to inform an Appropriate Assessment

December 2010

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Executive Summary

Introduction

Scott Wilson has been appointed by East Riding of Yorkshire Council on behalf of the Humber Estuary Coastal Authority Group (HECAG) to assist in undertaking a Habitat Regulations Assessment of the potential effects of the emerging Shoreline Management Plan (SMP) on internationally important wildlife sites. This report documents that Habitat Regulations Assessment including both an appraisal of Likely Significant Effects and an Appropriate Assessment.

Summary of Screening

It was concluded that significant effects on Flamborough Head Special Area of Conservation (SAC), Flamborough Head to Bempton Cliffs Special Protection Area (SPA), Hornsea Mere SPA and Inner Dowsing, Race Bank & North Ride pSAC could be described as unlikely due to the absence of any impact pathway linking SMP policy to the interest features of these sites.

Appropriate Assessment

It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This section therefore summarises the adverse effects that would arise from SMP policy in the absence of any such measures:

The Humber Estuary SAC/SPA/Ramsar site

The Appropriate Assessment concluded that the following adverse effects may result from SMP policies:

Epoch 1

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- An adverse effect on the internationally important habitats and bird interest of The Lagoons SSSI (Easington Lagoons) as a result of a HTL policy in Policy Unit I resulting in coastal squeeze;
- An adverse effect on the intertidal mudflats and pioneer saltmarsh (and on the bird interest of the SPA) in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether; and
- A possible adverse effect on the intertidal mudflats and sandflats (and thus SPA features) that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy.
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy and possible increase in defence

footprint to meet P4 requirements, which differs from the Humber Flood Risk Management Strategy policy for this Unit.

The coastal squeeze effects will act 'in combination' on the estuary as a whole with the HTL policies for the Inner and Middle Estuaries as set out in the Humber Flood Risk Management Strategy, which will also lead to coastal squeeze.

Epoch 2

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether; and
- An adverse effect on the intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy. This reduction in habitat extent will in turn lead to a decline in the quantity of habitat available for the population of passage and wintering waterfowl in these areas.
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

The coastal squeeze effects will act 'in combination' on the estuary as a whole with the HTL policies for the Inner and Middle Estuaries as set out in the Humber Flood Risk Management Strategy, which will also lead to coastal squeeze.

Epoch 3

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- A continuing adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether.
- Continuing adverse effects on the intertidal mudflats within Policy Units L and M. Adverse effects may (as a worst case scenario) also occur on the coastal lagoons, sand dune and saltmarsh in Policy Unit N due to a shift from accretion to erosion, leading to habitat loss for SPA birds;
- An adverse effect on sandflat habitat available for the grey seal colony at Donna Nook and the natterjack toad colony at Saltfleet within Policy Unit N as a result of coastal squeeze due to a HTL policy, as well as an accompanying loss of intertidal habitat for SPA birds; and

- An adverse effect throughout the Humber Estuary SAC as a result of increased erosion associated with a reduction in sediment deposition as a result of the coastal defences with Policy Unit L and Policy Unit M and Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast. It should be noted that this uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, the SMP Action Plan must include measures to further investigate and resolve this issue such that any revisions to policy can be made following the obtaining of further data.
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC/ Gibraltar Point SPA/Gibraltar Point Ramsar site

The Appropriate Assessment concluded that the following adverse effects may result from SMP policies:

- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.
- Adverse effects from **Epoch 3** on the dune system and saltmarsh through coastal squeeze as artificial replenishment of sediment up-drift and sediment transported from offshore fails to counterbalance the accelerating rate of sea level rise. This will occur as a result of the HTL policy in Units N and P;
- An adverse effect from **Epoch 3** on the dune system as sediment transport into the SAC declines due to a HTL policy for Policy Unit O.

The Wash & North Norfolk Coast SAC/ The Wash SPA & Ramsar site

The Appropriate Assessment concluded that the following adverse effects may result on the integrity of the SAC, SPA and Ramsar site, particularly when considered in combination with the HTL policies contained within The Wash SMP:

- An adverse effect from **Epoch 3** due to the reduction in sediment inputs arising from a HTL policy in Policy Units B D, F, H and N - P.

It was therefore considered necessary to incorporate wording into the final policies to enable the delivery of avoidance, mitigation or (if neither is possible) compensation for the above adverse effects.

Amendments Made to Policy to Facilitate Avoidance or Mitigation

Mitigation for disturbance of waterfowl and landtake due to defence footprint (all sites in all Epochs)

A form of words was devised for the SMP or Action Plan which addresses this issue, such as '*works will be timed to avoid significant disturbance*'. The following wording was also incorporated into the SMP in order to address issues of defence footprint: '*The working areas for each flood defence scheme will be subject to detailed design in order to minimise the defence footprint. There will be no increase in defence footprint unless adverse effects on the integrity of European sites can be avoided, or unless there are no alternatives and an IROPI test is made and any compensatory habitat creation agreed*'.

Mitigation - (Humber Estuary SAC/SPA/Ramsar site – Epoch 3)

The SMP Action Plan will include an action to further investigate the sediment supply issue, commencing in Epoch 1. Any investigation would need to include exploration of the effectiveness of measures to avoid or mitigate this effect. Until the Action Plan study mentioned above is completed, the SMP policies for Units E and H allow flexibility such that offsetting sediment release could be achieved, particularly in future epochs.

Mitigation - (Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC/ Gibraltar Point SPA & Ramsar site - Epoch 3)

SMP policy will address a potential decline in sediment supply in Epoch 3 through allowing for the need to adopt MR within Policy Units N, O and P to allow for continued supply of sediment if it proves necessary

Mitigation – (The Wash & North Norfolk Coast SAC / The Wash SPA/ The Wash Ramsar site - Epoch 3)

SMP policy will ensure that the SMP area continues to contribute sediment to The Wash during Epoch 3 through the following policies:

- Policy Units A, C, E (except for Mappleton) and G – These are all along the Holderness Coast and are No Active Intervention, which will ensure the continued feed of sediment to down-drift areas, thus helping to maintain important features such as Spurn, and the supply of sediment to the Humber and Lincolnshire coast;
- Policy Unit E – This Policy Unit is NAI for most of its length. However during Epochs 1 and 2 it also includes a small section of HTL at Mappleton. This will be associated with monitoring of coastal processes to determine whether continuing to hold the line at Mappleton is still sustainable in Epoch 3. As such, the policy includes flexibility for a change in policy to NAI to release more sediment from the Holderness Coast at Mappleton within Epoch 3;
- Policy Unit H – This Policy Unit is HTL for current defences and NAI elsewhere. However, if planning permission for the defences is not extended or there was no longer a strategic need for the site, defences in front of Easington Gas Terminal could be removed and No Active Intervention could then be undertaken. If this takes place it will contribute to a release of sediment from the Holderness Coast;
- Policy Units N, O and P allow for Managed Realignment to be considered locally, where appropriate during Epoch 3.

The incorporation of the above mitigation measures do enable us to conclude that there will be no adverse effect on any European sites through disturbance of waterfowl or reduction in sediment supply as a result of SMP policies. However, the mitigation measures above do not enable us to conclude that coastal squeeze impacts on the Humber Estuary SAC, SPA or Ramsar site will be either avoided or mitigated to such an extent that they can be described as ‘unlikely to be significant’.

It was therefore necessary for additional policy wording to be devised that would facilitate the delivery of compensatory habitat in appropriate policy units within the outer Humber Estuary. These are set out below.

Amendments made to policy to facilitate compensatory habitat to be provided through the HFRMS in Epochs 1 and 2

Epoch 1

Adverse effects on intertidal mudflats and saltmarsh and habitat for wintering waterfowl in Policy Units I, K and L due to coastal squeeze

The delivery of this habitat creation during Epoch 1 is facilitated by the SMP policies for Units K and N of the Humber Estuary. The policy wording for both Units states that '*To ensure sustainable flood defence and to meet the requirements of environmental legislation, detailed studies will identify sites for limited managed realignment in the order of 100 hectares on the north [or in the case of Unit N, south] bank of the Humber Estuary*'. This policy for Unit K will enable additional habitat to be provided to replace the loss of the high-tide roost function of The Lagoons, while the policy for Unit N will enable the creation of replacement shingle habitat in a policy unit in which little terns have previously been known to nest.

Epoch 2

Delivery of long-term habitat creation for effects on the Lagoons SSSI

The delivery of this compensation during Epoch 2 is addressed by the policy for Policy Unit I. This Policy Unit is HTL (P3) for the current defences with NAI elsewhere, across all 3 Epochs, but the Policy comments make it clear that options other than HTL in Epochs 2 and 3 may be considered subject to monitoring of coastal processes, future studies and third party decisions and that limited MR may occur, informed by the Humber Flood Risk Management Strategy. This would enable the provision of replacement for the Easington Lagoons habitat which will enable habitat creation to be provided for the long term preservation of the interest features of Easington Lagoons.

Adverse effects on SAC habitats and habitat for wintering SPA waterfowl in Policy Units K and L due to coastal squeeze

Additional realignment schemes will continue to be sought in the Strategy as opportunities arise. SMP policy enables this through the preferred policy for Policy Units K and N, as for Epoch 1, since these both allow for MR during Epoch 2.

Amendments made to policy to facilitate any need for compensatory provision in Epoch 3 with regard to the Humber Estuary SAC, SPA & Ramsar site

Loss of intertidal habitat in Units K, L, M and N due to coastal squeeze

The SMP policy has been amended to address this through the preferred policies for Policy Units K, M (to a small extent) and N, since these all allow for MR during Epoch 3. Managed Realignment in Unit N will not only permit intertidal habitats to migrate inland (thus providing compensatory intertidal sandflat for the grey seals at Donna Nook) but will also enable the inland migration of sand dune habitat in order to compensate for any loss of dune habitat for natterjack toads elsewhere in the Policy Unit.

Possible compensation that might required before the end of Epoch 3 to assist in offsetting increased intertidal habitat losses due to reduced sediment supply

If compensatory habitat creation is required to supplement additional sediment release and nourishment, this will need to take the form of a new area of managed realignment in a location that is rendered less vulnerable to sediment supply issues. These locations could be within the inner and middle estuaries or within the outer estuary in policy units K or N (which already allow for the provision of managed realignment) with the realignment designed to maximise sediment capture. It is not possible to estimate with any accuracy the scale of habitat creation required as compensation at this stage, particularly since in practice it may prove unnecessary to deliver it at all. Therefore this must be resolved through the Action Plan study identified previously.

Final Conclusion

With the adoption of the policy wording detailed in Chapters L12 it can be concluded that there will be no adverse effect on any European sites through disturbance of waterfowl or reduction in sediment supply as a result of SMP policies and no adverse effects on Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC, Gibraltar Point SPA or Gibraltar Point Ramsar site.

The mitigation measures in that Chapter do not enable us to conclude that coastal squeeze impacts on the Humber Estuary SAC, SPA or Ramsar site will be either avoided or mitigated to such an extent that they can be described as 'unlikely to be significant'. It is therefore necessary for the competent authority to make a case for a) no alternatives and b) Imperative Reasons of Overriding Public Interest to the Secretary of State.

In order to make the 'IROPI case' it was necessary for additional policy wording to be devised that would facilitate the delivery of an adequate scale of compensatory habitat in appropriate policy units within the outer Humber Estuary. This has been accomplished as described in Chapters L14 and L15 in discussion with Natural England and the Environment Agency. As part of the IROPI process it is also necessary for an evaluation of alternatives to maintaining the defences to be made and for a justification for adopting the policy despite the adverse effects to be made on the basis of Imperative Reasons of Overriding Public Interest. The 'no alternatives' and 'IROPI' justifications are contained in a separate document to be produced shortly.

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L1 Introduction

Habitat Regulations Assessment

- L1.1 A Shoreline Management Plan (SMP) is a non-statutory, policy document for coastal flood and erosion risk management planning. Its main objective is to identify sustainable long-term management policies for the coast. The plan enables social, environmental and economic assets affected by coastal flood and erosion to be managed in the best way over the long term.
- L1.2 In order to comply with the requirements of Article 6 of the EC Habitats Directive 1992 (interpreted into English law by the Conservation of Habitats and Species Regulations 2010) land use plans must be subject to Appropriate Assessment where they are likely to have a significant effect on a Natura 2000 site (Special Areas of Conservation, SAC and Special Protection Areas, SPA). It is also Government policy (as described in Planning Policy Statement 9: Biodiversity & Geological Conservation) for candidate Special Areas of Conservation (cSAC), proposed Special Protection Areas (pSPA) and sites designated under the Convention on Wetlands of International Importance 1971 (Ramsar sites) to be treated as having equivalent status to designated Natura 2000 sites. Collectively, we refer to these sites throughout this report as 'internationally important wildlife sites'.
- L1.3 The Habitats Directive applies the precautionary principle to protected areas so that plans and projects can only be permitted having ascertained that there will be no adverse effect on the integrity of the site(s) in question. Plans and projects may still be permitted if there are no alternatives to them and there are Imperative Reasons of Overriding Public Interest (IROPI) as to why they should go ahead. In such cases, compensation would be necessary to ensure the overall coherence of the site network.
- L1.4 In order to ascertain whether or not site integrity will be affected, an Appropriate Assessment should be undertaken of the plan or project in question, Box 1 below set out the legislative basis for such an assessment.

Box 1. The legislative basis for Habitat Regulations Assessment

Habitats Directive 1992

Article 6 (3) states that:

“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives.”

Conservation of Habitats & Species Regulations 2010

The Regulations state that:

“A competent authority, before deciding to ... give any consent for a plan or project which is likely to have a significant effect on an internationally important wildlife site ... shall make an appropriate assessment of the implications for the site in view of that sites conservation objectives ... the authority shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the Internationally important wildlife site”.

- L1.5 In recent years the term Habitat Regulations Assessment has come into use in order to distinguish the process required by the Habitat Regulations (including screening to determine whether adverse effects are likely) from the specific Appropriate Assessment stage. For the rest of this document Habitat Regulations Assessment will be used to refer to the overall process and Appropriate Assessment to refer to the specific Appropriate Assessment stage.

Objectives and Scope

Objectives

- L1.6 Scott Wilson has been appointed by East Riding of Yorkshire Council on behalf of the Humber Estuary Coastal Authority Group (HECAG) to assist in undertaking a Habitat Regulations Assessment of the potential effects of the emerging SMP on internationally important wildlife sites. This report documents that Habitat Regulations Assessment including both an appraisal of Likely Significant Effects and the Appropriate Assessment of those effects that could not be considered unlikely.

‘Tiering’ of SMPs and Strategies

- L1.7 It is important to note that the SMP sets policies for the shoreline not the location or scale of the policy or the measure(s) that will implement such a policy. Since SMPs form the initial and most strategic stage in a tiered system, with each tier adding a further level of detail, the Habitat Regulations Assessment work to accompany these documents also needs to be tiered. In other words, the work done needs to acquire more detail as each tier is negotiated, culminating with the most detailed Habitat Regulations Assessment being undertaken at the individual scheme level. This is in line with Communities & Local Government (CLG) guidance on the Appropriate Assessment of Land Use Plans which makes it clear that:
- L1.8 *“The comprehensiveness of the [Appropriate] assessment work undertaken should be proportionate to the geographical scope of the option and the nature and extent of any effects identified. An Appropriate Assessment need not be done in any more detail, or using more resources, than is useful for its purpose. It would be inappropriate and impracticable to assess the effects [of a land use plan] in the degree of detail that would normally be required for the Environmental Impact Assessment (EIA) of a project.”*
- L1.9 In practice this means that a high-tier document such as an SMP needs to set an adequate policy framework for the delivery of necessary measures to avoid or, if avoidance is not possible, adequately mitigate any adverse effects on internationally important wildlife sites, rather than to set out the detailed measures themselves. However, some limited consideration of possible mitigation or avoidance measures is necessary in order to ensure that such measures are indeed available and viable.

Scope of the Habitats Regulations Assessment

- L1.10 The physical scope of the Habitat Regulations Assessment is considered to include all internationally important wildlife sites that lie within the SMP area and those outside the SMP area for which there is a pathway that links them to coastal defence decisions taken within the area. In practice this latter group consists of The Wash & North Norfolk Coast SAC and The Wash SPA & Ramsar site, since The Wash is a sediment sink which obtains a significant proportion of its sediment from the Holderness and Lincolnshire coast. The following internationally designated wildlife sites have therefore been covered in this Habitat Regulations

Assessment (Figure 1.1). These are illustrated in Figure 1 in relation to the Policy Units within the SMP area, with the exception of Inner Dowsing, Race Bank and North Ridge pSAC.

Internationally designated wildlife site
Flamborough Head SAC
Flamborough Head to Bempton Cliffs SPA
Hornsea Mere SPA
Humber Estuary SAC
Humber Estuary SPA
Humber Estuary Ramsar site
Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC
Gibraltar Point SPA
The Wash & North Norfolk Coast SAC
The Wash SPA
The Wash Ramsar site
Inner Dowsing, Race Bank & North Ridge pSAC

Figure 1.1: Internationally designated wildlife sites covered in this Habitat Regulations Assessment

- L1.11 The Habitat Regulations Assessment assesses adverse effects on the interest features for which the internationally designated wildlife sites were designated using the 2009 situation as the baseline reference point, thus allowing us to take into consideration the current condition of the internationally important wildlife sites and any changes in the interest features which have occurred since the sites were internationally designated. At the same time, account is taken of any trend predictions (e.g. predictable future alternations in response to climate change or other variables).
- L1.12 Since the SMP covers such a long timescale (up to 100 years) impacts that may occur in Epoch 1 are considered in most detail, while those in Epoch 2 and (particularly) Epoch 3 are considered in outline. The reason for this is that background environmental/ecological circumstances may change considerably over 100 years and it is therefore almost impossible to predict accurately at this stage what the impacts or ecological context will be during Epochs 2 and 3. These Epochs will need to be reassessed during future revisions of the SMP.

Report structure

- L1.13 Chapter 2 of this report presents the methodology that we have used. Chapter 3 discusses the potential impacts that can result on internationally designated wildlife sites as a result of SMP policies, Chapter 4 then screens the SMP policies by examining them in the context of the interest features and vulnerabilities of each internationally designated wildlife site and determining whether significant effects can be described as unlikely. Chapters 5 – 7 then documents the Appropriate Assessment of those SMP preferred policies that could not be screened out. Chapter 8 summarises the conclusions of the Appropriate Assessment, while Chapter 9 discusses avoidance, mitigation and compensation.
- L1.14 It should be noted that throughout this report information on and descriptions of coastal and sediment processes are taken from Appendix C (Baseline Understanding of Coastal Processes and Baseline Scenarios) of the Flamborough Head to Gibraltar Point SMP. Background ecological data (unless indicated otherwise) is taken from the Joint Nature Conservation Committee website and the Natura 2000 data sheets for the relevant internationally designated wildlife sites.

L2 Methodology

Overall Habitats Regulations Assessment process

- L2.1 The Habitat Regulations Assessment has been carried out in the absence of formal Government guidance on Habitat Regulations Assessment of plans. Communities and Local Government (CLG) released a consultation paper on 'Appropriate Assessment of Plans' in 2006¹. As yet, no further formal guidance has emerged.
- L2.2 Figure 2.1 below outlines the stages of Habitat Regulations Assessment according to current draft CLG guidance. The stages are essentially iterative, being revisited as necessary in response to more detailed information, recommendations and any relevant changes to the plan until no significant adverse effects remain.

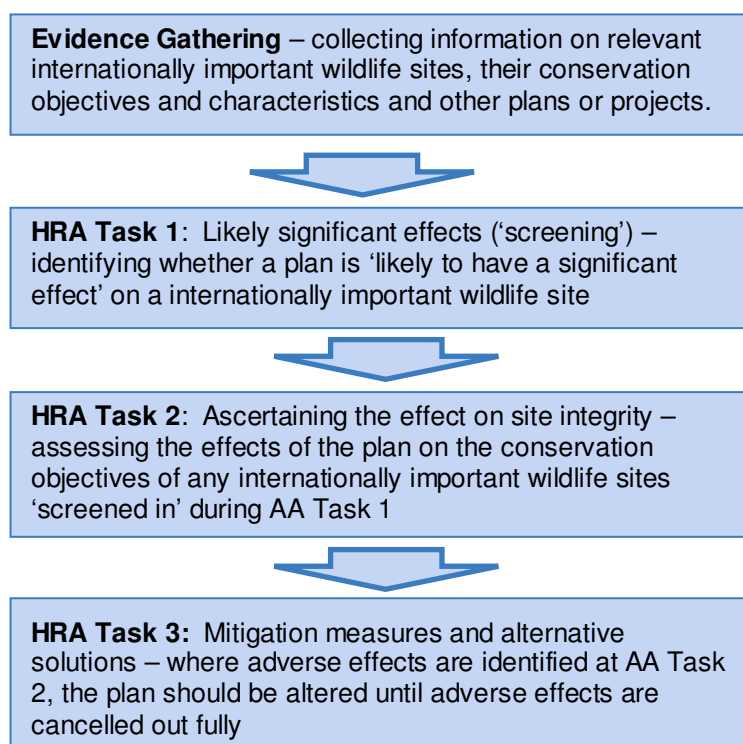


Figure 2.1: Four-Stage Approach to Habitat Regulations Assessment

Source: CLG, 2006

Likely Significant Effects

- L2.3 The first step in Habitat Regulations Assessment is a simple screening exercise to determine Likely Significant Effects - essentially a high level risk assessment to decide whether the full subsequent stage known as Appropriate Assessment is required. The essential question is:

¹ CLG (2006) *Planning for the Protection of Internationally important wildlife sites*, Consultation Paper

- L2.4 *"Is the Plan, either alone or in combination with other relevant projects and plans, likely to result in a significant effect upon internationally important wildlife sites?"*
- L2.5 The objective is to 'screen out' those plans and projects that can, without any detailed appraisal, be said to be unlikely to result in significant effects upon internationally important wildlife sites, usually because there is no mechanism or pathway connecting the plan/project with internationally important wildlife sites.

Appropriate Assessment

- L2.6 The potential for impacts on internationally important wildlife sites have been taken into account through the development of the SMP and its policies up to this point, such that the need to avoid adverse effects on these sites has been considered.
- L2.7 CLG guidance on Appropriate Assessment of land use plans states that: *'It would be inappropriate and impracticable to assess the effects [of a land use plan] in the degree of detail that would normally be required for the Environmental Impact Assessment (EIA) of a project'*. In line with this, we have utilised existing data generated for the Flamborough Head to Gibraltar Point SMP and available from other sources (in particular the Habitat Status of the Humber Estuary Report²) to undertake this assessment, rather than undertake bespoke survey or modelling. Bespoke survey and modelling will be appropriate at the individual scheme level.
- L2.8 The level of detail concerning developments that will be permitted under many land use plans (particularly high-tier plans such as the Flamborough Head to Gibraltar Point SMP) is generally insufficient to make a detailed assessment of significance of effects, beyond levels of risk. As such, individual policy options are evaluated against the environmental conditions necessary to maintain the integrity of the internationally important wildlife site with consideration being given to the timing, duration, reversibility and scale of any adverse effect. In making these decisions, Scott Wilson has relied on the professional judgement of its staff as well as advice from Natural England. Importantly, we have made use of the precautionary principle. Where uncertainty over significance exists and it cannot be ruled out, then it has been considered as significant.
- L2.9 In particular, reference is made to ensuring that each policy option is appraised not in isolation but within the context of ('in combination' with) other relevant plans and projects.

Other plans and projects

- L2.10 It is neither practical nor necessary to assess the 'in combination' effects of the SMP within the context of all other plans and projects within the East Riding of Yorkshire, North East Lincolnshire and East Lindsey. In practice therefore, in combination assessment is of greatest relevance when the plan would otherwise be screened out because its individual contribution is inconsequential. Due to the nature of the identified impacts, the key other plans and projects relate to the adjacent SMP for The Wash and those aspects of the Humber Flood Risk Management Strategy that are not covered by the Flamborough Head to Gibraltar Point SMP itself (i.e. the measures for the inner and middle estuaries) or which differ in terms of policy (specifically regarding the approach to Unit K).

² Hemingway, K.L., Cutts, N.D., Allen, J.H. & S. Thomson, 2008. Habitat Status of the Humber Estuary, UK. Institute of Estuarine & Coastal Studies (IECS), University of Hull, UK. Report produced as part of the European Interreg IIB HARBASINS project

L2.11 It is also considered appropriate to include the additional housing, transportation and commercial/industrial allocations proposed for the SMP coast over Epoch 1. This development will be delivered by the East Yorkshire Local Development Framework (LDF) and the East Lindsey LDF. While the precise location of housing has not been determined, it is reasonable to assume on a precautionary basis that the increased population associated with this new residential development may result in increased recreational pressure within the Humber Estuary in particular.

L2.12 Epochs 2 and 3 are sufficiently far in the future that no other plans or projects that will commence within those epochs have been identified.

L2.13 During discussions with Natural England in preparation for this Habitat Regulations Assessment, the following plans and projects were identified for consideration 'in combination' with the SMP:

North East Lincolnshire

- Humber Flood Risk Management Strategy (i.e. measures to be delivered in the inner and middle estuaries which are not covered by the SMP or which differ in terms of policy - specifically regarding the approach to Unit K);
- Helius Energy biomass plant at Stallingborough;
- New 20,000 seat Grimsby town football stadium at Great Coates;
- Abengoa bioethanol plant at Stallingborough;
- Grimsby Proposed 'Roll on –Roll off' ferry berth; and
- Vireol bioethanol plant at Grimsby.

East Riding Of Yorkshire

- Humber Flood Risk Management Strategy (i.e. measures to be delivered in the inner and middle estuaries which are not covered by the SMP); and
- East Yorkshire Local Development Framework.

East Lindsey

- East Lindsey Local Development Framework.

Further developments/sources of disturbance

- Windfarms including offshore windfarms: potential to be proposed in various locations.
- Iota Dredge;
- Possible future tidal pulse generator 'The Wash Tidal Barrier' (currently in its early stages); and
- The Wash SMP

L2.14 Since it is not possible to predict what proposals for projects, plans or policies will arise in the next 100 years within and around the SMP area, the list of proposals will be updated and the

‘in-combination’ assessment will be re-visited every time the SMP and Habitat Regulations Assessment are revised.

Avoidance, mitigation and compensation

- L2.15 For each Policy Unit in which adverse effects have been identified, we have reviewed the decisions made to reach that policy option and explored whether avoidance of the effect is possible. Any recommendations for such avoidance measures are put forward in terms of the policy mechanism or framework for delivery of such measures rather than the detail of the measures themselves. However, where such details are available (i.e. from the Appropriate Assessment prepared for the Humber Flood Risk Management Strategy) we have included reference to them.
- L2.16 Compensation options are only explored as a last resort once all reasonable options for avoidance or mitigation have been exhausted, since it must be demonstrable that a) no reasonable alternatives exist and b) there are IROPI for nonetheless proceeding with the option (e.g. public safety). If it is not possible to avoid or adequately mitigate adverse effects then it will be necessary to explore options for compensation (i.e. creating replacement habitat elsewhere in order to preserve the overall Natura 2000 network).
- L2.17 For those Policy Units where compensation is the only option, proposals will be developed and discussed with Natural England and Defra as part of the development of the relevant Coastal Strategy. The relevant Coastal Scheme will include details of any compensation required and deliver the habitat compensation to the appropriate timescale. These will include details of:
- When the compensation will be provided;
 - Broad locations for the provision of compensation;
 - An indication of the probable scale of compensatory habitat to be provided; and
 - Indication of monitoring and management work to be carried out, along with targets to be met and triggers for remedial works.

L3 Pathways of impact

- L3.1 There are various ways in which a SMP can result in adverse effects on internationally designated wildlife sites, principally as a result of maintaining a 'Hold the Line' or 'Advance the Line' policy. Managed realignment also has the potential to adversely affect such sites. These pathways are discussed in this chapter.
- L3.2 The generic shoreline management policies considered are those defined by the Department for Environment, Food and Rural Affairs (Defra) in their SMP guidance (2006)³. They are defined as:
- No Active Intervention (NAI): a decision not to invest in providing or maintaining defences.
 - Hold the Line (HTL): hold the existing defence line. This policy will cover those situations where work or operations are carried out on the existing defences (such as beach recharge, rebuilding the toe of a structure, building offshore breakwaters and so on). Included in this policy are other policies that involve operations to the back of existing defences (such as building secondary floodwalls) where they form an essential part of maintaining the current coastal defence system.
 - Advance the Line (ATL): advance the existing defence line by building new defences on the seaward side of the original defences. Using this policy should be limited to those policy units where significant land reclamation is considered.
 - Managed Realignment (MR): managed realignment by allowing the shoreline to move backwards, with management to control or limit movement (such as building new defences on the landward side of the original defences).
- L3.3 In addition to the four generic shoreline management policy options described above, this SMP has made use of a fifth policy: hold the line on a realigned position (HR). This has been used for reasons of clarity in areas where the policy is managed realignment for an early epoch. The policy of hold the line on a realigned position may then be specified for subsequent epochs (in preference to a hold this line policy) as this gives greater clarity over which defence line is being held.

Coastal squeeze

- L3.4 Rising sea levels can be expected to cause intertidal habitats (principally saltmarsh and mudflats) and sand dunes to migrate landwards. However, in built-up areas, such landward retreat is often rendered impossible due the presence of the sea wall and other flood defences.
- L3.5 In addition, development frequently takes place immediately behind the sea wall, so that the flood defences cannot be moved landwards to accommodate managed retreat of threatened habitats. The net result of this is that the quantity of saltmarsh and mudflat adjacent to built-up areas will progressively decrease as sea levels rise. This process is known as 'coastal squeeze'. In areas where sediment availability is reduced, the 'squeeze' also includes an increasingly steep beach profile and foreshortening of the seaward zones.

³ Defra, 2006. Shoreline management plan guidance Volume 1: Aims and requirements. London: Department for Environment, Food and Rural Affairs.
Defra, 2006. Shoreline management plan guidance Volume 2: Procedures. London: Department for Environment, Food and Rural Affairs.

- L3.6 Along large stretches of the UK coastline, high and low watermarks on the beaches are moving landwards. Intertidal habitat loss is mainly occurring in the south and east of the country, particularly between the Humber and Severn. Northwest England, south Wales, the Solent in Hampshire, the southeast around the Thames estuary and large parts of East Anglia are also affected. The south coast has experienced the greatest steepening.
- L3.7 Defra's current national assessment is that the creation of an annual average of at least 100 ha of intertidal habitat will be required to offset losses from International Important Wildlife Sites in England affected by coastal squeeze. This would need to be considered together with any more specifically identified measures to replace losses of terrestrial and supra-tidal habitats, is likely to be required to protect the overall coherence of the Natura 2000 network. This assessment takes account of intertidal habitat loss from internationally important wildlife sites in England that is caused by a combination of all flood risk management structures and sea level rise. The assessment will be kept under review taking account of the certainty of any adverse effects and monitoring of the actual impacts of plans and projects.¹⁶

Direct loss due to Managed Realignment

- L3.8 While MR policies (i.e. policies that require flood defences to be moved) can have a beneficial impact on internationally designated sites through allowing intertidal habitats to retreat inland in response to rising sea levels, they can (depending on the site and habitats) also have an adverse effect if the flood defences actually serve to protect habitat that does not require inundation. For example, in the Medway and Swale area, it was concluded that MR policies would have a beneficial effect on the intertidal habitat but an adverse effect on the grazing marsh that currently lies behind the defences.

Direct disturbance

- L3.9 Depending on the timing of works the various policies adopted for a SMP can also indirectly result in disturbance of the species for which the internationally important wildlife site was designated, particularly for those sites designated for bird interest. On such sites, flood defence maintenance can cause short-term localised disturbance of breeding birds or wintering birds depending on the time of year.
- L3.10 Concern regarding the effects of disturbance on birds stems from the fact that they are expending energy unnecessarily and the time they spend responding to disturbance is time that is not spent feeding⁴. Disturbance therefore risks increasing energetic output while reducing energetic input, which can adversely affect the 'condition' and ultimately survival of the birds. In addition, displacement of birds from one feeding site to others can increase the pressure on the resources available within the remaining sites, as they have to sustain a greater number of birds.⁵ Moreover, the more time a breeding bird spends disturbed from its nest, the more its eggs are likely to cool and the more vulnerable they are to predators.

¹⁶ Defra. 2005. Coastal Squeeze – Implications for Flood Management.

<http://www.defra.gov.uk/environ/fcd/policy/csqueeze.pdf>

⁴ Riddington, R. *et al.* 1996. The impact of disturbance on the behaviour and energy budgets of Brent geese. *Bird Study* 43:269-279

⁵ Gill, J.A., Sutherland, W.J. & Norris, K. 1998. The consequences of human disturbance for estuarine birds. *RSPB Conservation Review* 12: 67-72

- L3.11 Winter activity can also cause significant disturbance, especially as birds are particularly vulnerable at this time of year due to food shortages. Several empirical studies have, through correlative analysis, demonstrated that out-of-season recreational activity can result in quantifiable disturbance. Such studies include the following:
- Tuite *et al*⁶ found that during periods of high recreational activity, bird numbers at Llangorse Lake decreased by 30% as the morning progressed, matching the increase in recreational activity towards midday. During periods of low recreational activity, however, no change in numbers was observed as the morning progressed. In addition, all species were found to spend less time in their 'preferred zones' (the areas of the lake used most in the absence of recreational activity) as recreational intensity increased.
 - Underhill *et al*⁷ counted waterfowl and all disturbance events on 54 water bodies within the South West London Water bodies Special Protection Area and clearly correlated disturbance with a decrease in bird numbers at weekends in smaller sites and with the movement of birds within larger sites from disturbed to less disturbed areas.
 - Evans & Warrington⁸ found that on Sundays total water bird numbers (including shoveler and gadwall) were 19% higher on Stocker's Lake Local Nature Reserve in Hertfordshire, and attributed this to observed greater recreational activity on surrounding water bodies at weekends relative to week days. However, recreational activity was not quantified in detail and individual recreational activities were not evaluated separately.
 - Tuite *et al*⁹ used a large (379 site), long-term (10-year) dataset (September – March species counts) to correlate seasonal changes in wildfowl abundance with the presence of various recreational activities. They found that shoveler was one of the most sensitive species to disturbance. The greatest impact on winter wildfowl numbers was associated with sailing/windsurfing and rowing.
- L3.12 Human activity can affect birds either directly (e.g. through causing them to flee) or indirectly (e.g. through damaging their habitat). The most obvious direct effect is that of immediate mortality such as death by shooting, but human activity can also lead to behavioural changes (e.g. alterations in feeding behaviour, avoidance of certain areas *etc.*) and physiological changes (e.g. an increase in heart rate) that, although less noticeable, may ultimately result in major population-level effects by altering the balance between immigration/birth and emigration/death.¹⁰
- L3.13 The degree of impact that varying levels of noise will have on different species of bird is poorly understood except that a number of studies have found that an increase in traffic levels on roads does lead to a reduction in the bird abundance within adjacent hedgerows - Reijnen *et al* (1995) examined the distribution of 43 passerine species (i.e. 'songbirds'), of which 60% had a

⁶ Tuite, C. H., Owen, M. & Paynter, D. 1983. Interaction between wildfowl and recreation at Llangorse Lake and Talybont Reservoir, South Wales. *Wildfowl* 34: 48-63

⁷ Underhill, M.C. *et al.* 1993. *Use of Waterbodies in South West London by Waterfowl. An Investigation of the Factors Affecting Distribution, Abundance and Community Structure.* Report to Thames Water Utilities Ltd. and English Nature. Wetlands Advisory Service, Slimbridge

⁸ Evans, D.M. & Warrington, S. 1997. The effects of recreational disturbance on wintering waterbirds on a mature gravel pitlake near London. *International Journal of Environmental Studies* 53: 167-182

⁹ Tuite, C.H., Hanson, P.R. & Owen, M. 1984. Some ecological factors affecting winter wildfowl distribution on inland waters in England and Wales and the influence of water-based recreation. *Journal of Applied Ecology* 21: 41-62

¹⁰ Riley, J. 2003. Review of Recreational Disturbance Research on Selected Wildlife in Scotland. Scottish Natural Heritage.

lower density closer to the roadside than further away. By controlling vehicle usage they also found that the density generally was lower along busier roads than quieter roads¹¹.

- L3.14 Activity will often result in a flight response (flying, diving, swimming or running) from the animal that is being disturbed. This carries an energetic cost that requires a greater food intake. Research that has been conducted concerning the energetic cost to wildlife of disturbance indicates a significant negative effect.
- L3.15 Disturbing activities are on a continuum. The most disturbing activities are likely to be those that involve irregular, infrequent, unpredictable loud noise events, movement or vibration of long duration. Birds are least likely to be disturbed by activities that involve regular, frequent, predictable, quiet patterns of sound or movement or minimal vibration. The further any activity is from the birds, the less likely it is to result in disturbance.
- L3.16 The factors that influence a species response to a disturbance are numerous, but the three key factors are species sensitivity, proximity of disturbance sources and timing/duration of the potentially disturbing activity.

Sensitivity of species

- L3.17 The distance at which a species takes flight when approached by a disturbing stimulus is known as the 'tolerance distance' (also called the 'escape flight distance') and differs between species to the same stimulus and within a species to different stimuli. Distances for shoveler have been recorded. These are given in Table 3.1, which compiles 'tolerance distances' from across the literature. However, construction activities and flood defence maintenance activities may result in greater levels of disturbance.

Table 3.1 Tolerance distances of 21 water bird species to various forms of recreational disturbance, as described in the literature. All distances are in metres. Single figures are mean distances; when means are not published, ranges are given. ¹ Tydeman (1978), ² Keller (1989), ³ Van der Meer (1985), ⁴ Wolff *et al* (1982), ⁵ Blankestijn *et al* (1986).¹²

Species	Type of disturbance		
	Rowing boats/kayak	Sailing boats	Walking
Little grebe		60 – 100 ¹	
Great crested grebe	50 – 100 ²	20 – 400 ¹	
Mute swan		3 – 30 ¹	
Teal		0 – 400 ¹	

¹¹ Reijnen, R. *et al.* 1995. The effects of car traffic on breeding bird populations in woodland. III. Reduction of density in relation to the proximity of main roads. *Journal of Applied Ecology* 32: 187-202

¹² Tydeman, C.F. 1978. *Gravel Pits as conservation areas for breeding bird communities*. PhD thesis. Bedford College
Keller, V. 1989. Variations in the response of Great Crested Grebes *Podiceps cristatus* to human disturbance - a sign of adaptation? *Biological Conservation* 49:31-45

Van der Meer, J. 1985. *De verstoring van vogels op de slikken van de Oosterschelde*. Report 85.09 Deltadienst Milieu en Inrichting, Middelburg. 37 pp.

Wolf, W.J., Reijnders, P.J.H. & Smit, C.J. 1982. The effects of recreation on the Wadden Sea ecosystem: many questions but few answers. In: G. Luck & H. Michaelis (Eds.), *Schriftenreihe M.E.L.F., Reihe A: Agnew. Wissenschaft* 275: 85-107

Blankestijn, S. *et al.* 1986. *Seizoensverbreding in de recreatie en verstoring van Wulp en Scholkester op hoogwatervluchplaatsen op Terschelling*. Report Projectgroep Wadden, L.H. Wageningen. 261pp.

Species	Type of disturbance		
	Rowing boats/kayak	Sailing boats	Walking
Mallard		10 – 100 ¹	
Shoveler		200 – 400 ¹	
Pochard		60 – 400 ¹	
Tufted duck		60 – 400 ¹	
Goldeneye		100 – 400 ¹	
Smew		0 – 400 ¹	
Moorhen		100 – 400 ¹	
Coot		5 – 50 ¹	
Curlew			211 ³ ; 339 ⁴ ; 213 ⁵
Shelduck			148 ³ ; 250 ⁴
Grey plover			124 ³
Ringed plover			121 ³
Bar-tailed godwit			107 ³ ; 219 ⁴
Brent goose			105 ³
Oystercatcher			85 ³ ; 136 ⁴ ; 82 ⁵
Dunlin			71 ³ ; 163 ²

L3.18 With relation to the Flamborough Head to Gibraltar Point SMP, 7 of the internationally designated wildlife sites were designated for their breeding or wintering bird interest:

- Flamborough Head to Bempton Cliffs SPA (breeding birds);
- Hornsea Mere SPA (wintering birds);
- Humber Estuary SPA (breeding, wintering and passage birds);
- Humber Estuary Ramsar site (breeding, wintering and passage birds);
- Gibraltar Point SPA (breeding and wintering birds);
- The Wash SPA (breeding, wintering and passage birds); and
- The Wash Ramsar site (breeding, wintering and passage birds).

Changes in sediment regimes

L3.19 The Flamborough to Lincolnshire coastline can be considered to be a single coastal process system, in the sense that it is a coastline with high level interactions and critical dependencies. These interactions are related to the supply of sediment from shoreline erosion, sediment transport and deposition elsewhere within the system. A key factor in this unit is that there is a cascading series of compartments each with areas of erosion, transport and deposition.

L3.20 Sediment transport is typically wave-driven in a southerly direction throughout this entire longshore stretch. Exceptions to this general trend are located at two divergence zones: within Bridlington Bay and to the north and south of Donna Nook.

L3.21 Depending on the availability of mobile sediment, characteristic landforms develop in specific settings within these energy gradients. Fine grained sediments tend to accumulate in sheltered, low energy environments (e.g. the Humber Estuary with its inter-tidal mudflats and

saltmarshes) whereas coarse sediments can be found on the open coast where the energy inputs are higher (e.g. the sand and shingle beaches of Holderness, Spurn Head and Lincolnshire) or in seabed sinks or stores (e.g. the Humber mouth). The highest energy environments are characterised by rock cliffs (i.e. the reflective rock barrier of Flamborough Head).

L3.22 The combination of variable energy inputs and mobile sediment lead to on-going morphological adjustments of the shoreline, ranging from beach profile changes over the course of a single storm to long-term changes (e.g. hundreds to thousands of years) in response to factors such as relative sea-level rise or changes in sediment availability. If the energy regime changes then the landform will either be left as a relict form, replaced by a form that is more suited to the new setting (e.g. a change in sediment size or profile shape) or lost through erosion. The geomorphological response of a coastal system to natural changes in energy and materials is capable of significant modification by coastal management. For example, the provision of coastal defence structures can alter the morphological response of a coastline over a considerable distance.

L3.23 There are a series of inter-linked components that exhibit coherent behaviour patterns (shoreline behaviour units). These are:

- The Chalk Cliffs (Flamborough Head to Sewerby) – relating to Policy Unit A
- The Holderness Cliffs (Sewerby to Kilnsea) – relating to Policy Units B – I
- Spurn Head – relating to Policy Unit J
- The Outer Humber Bed and Banks – relating to Policy Units K – M and part of Unit N
- The Lincolnshire Coast (Donna Nook to Gibraltar Point) – relating to Policy Units N - P.

L4 Likely Significant Effects

Introduction

- L4.1 This chapter sets out the likely significant effect test (screening) that was undertaken for the 2009 preferred policies for each site.

Flamborough Head SAC

- L4.2 Flamborough Head SAC is designated for its vegetated sea cliffs, reefs and submerged or partially submerged sea caves.
- L4.3 The SAC falls within Policy Unit A (Flamborough Head to Sewerby). The preferred policy here is NAI in all epochs. In some instances a policy of NAI could lead to adverse effects on an internationally designated site if the site was to be threatened with inundation or erosion in the absence of intervention. However, the only potentially vulnerable features within the SAC are the cliffs themselves, and the cliff recession rates are low (0.03m/year to 0.4m/year)¹³ and while sea level rise is expected to result in accelerated cliff recession rates, these will remain low, in the range 0 to 0.4m/year. As such, the SMP policy is unlikely to lead to a significant effect on the interest features (and thus integrity) of the SAC.
- L4.4 Policy Unit B (Bridlington to Hilderthorpe) starts immediately south of the SAC. The preferred policy in this location is HTL (including management of the defences such that current standard of flood protection is maintained) in all epochs. However, there is no mechanism whereby a HTL policy in this Unit could lead to significant effects on the SAC.
- L4.5 There is no mechanism whereby policy decisions made in any of the other Policy Units within the SMP area could result in adverse effects upon the SAC. It has therefore been possible to screen out all SMP policies as being unlikely to lead to significant effects upon Flamborough Head SAC and the site is therefore not considered further in this report.

Flamborough Head to Bempton Cliffs SPA

- L4.6 Flamborough Head to Bempton Cliffs SPA is designated for its population of breeding kittiwake, which breed on the cliffs themselves and its wintering waterfowl (the SPA is designated for supporting more than 20,000 wintering waterfowl per annum, irrespective of species).
- L4.7 This SPA falls within Policy Unit A (Flamborough Head to Sewerby). The preferred policy here is NAI in all epochs (in other words, no action is proposed for this location). Although breeding and wintering cliff-dwelling birds can be vulnerable to disturbance the NAI policy will mean that the SMP will not introduce any disturbance sources to the area, even temporarily. As such, the SMP policy is unlikely to lead to a significant effect on the interest features (and thus integrity) of the SPA.
- L4.8 Policy Unit B (Bridlington to Hilderthorpe) starts approximately 4km south of the SPA. The preferred policy in this location is HTL (including management of the defences such that current

¹³ Institute of Estuarine and Coastal Studies (IECS) 1994a. Humber Estuary and Coast. Humberside County Council
Matthews E R, 1934. Coast erosion and protection. Ch. Griffin
Posford Duvier 1998. HECAG SMP1. Subcell 2a/2b. Flamborough Head to Donna Nook

standard of flood protection is maintained) in all epochs. However, there is no mechanism whereby a HTL policy in this Unit could lead to significant effects on the SPA.

- L4.9 There is no mechanism whereby policy decisions made in any of the other Policy Units within the SMP area could result in adverse effects upon the SPA. It has therefore been possible to screen out all SMP policies as being unlikely to lead to significant effects upon Flamborough Head to Bempton Cliffs SPA and the site is therefore not considered further in this report.

Hornsea Mere SPA

- L4.10 Hornsea Mere is designated for its population of wintering gadwall. Hornsea Mere SPA is separated from Policy Unit D (North Cliff to Hornsea Burton) by the settlement of Hornsea itself. As such, although the preferred policy is HTL across all epochs, there is no mechanism for this to result in significant effects on the SPA.
- L4.11 There is no mechanism whereby policy decisions made in any of the other Policy Units within the SMP area could result in significant effects upon the SPA. It has therefore been possible to screen out all SMP policies as being unlikely to lead to significant effects upon Hornsea Mere SPA and the SPA is therefore not considered further in this report.

Humber Estuary SAC

- L4.12 According to the official Joint Nature Conservation Committee (JNCC) citation for the Humber Estuary SAC, internationally important habitats within the Humber Estuary include Atlantic salt meadows and a range of sand dune types in the outer estuary, together with subtidal sandbanks, extensive intertidal mudflats, glasswort beds and coastal lagoons. Significant fish species include river lamprey and sea lamprey which breed in the River Derwent, a tributary of the River Ouse and there is a large grey seal breeding colony at Donna Nook.
- L4.13 Part of the Humber Estuary SAC lies physically outside the area covered by the SMP but still needs to be considered within this Habitat Regulations Assessment since the entire estuary (inner, middle and outer parts) is functionally linked. Those parts of the Humber Estuary SAC that do lie within the SMP area lie within Policy Units J (Kilnsea to Spurn Point), K (Easington Road to Stone Creek), L (East Immingham to Cleethorpes), M (Humberston Fitties) and N (South of Humberston Fitties to Theddlethorpe St Helen). The preferred policy in Policy Units K, L and N is HTL along the entire frontage in all Epochs. The preferred policy for Policy Unit M is HTL for all Epochs (holding the line only at the second line of defence by Epoch 3).
- L4.14 Given the vulnerability of the interest features of the Humber Estuary SAC to coastal squeeze it is difficult to say that there will be no significant effects as a result of the preferred SMP policies for these Units. Therefore Appropriate Assessment is required.
- L4.15 Due to the dynamic and unique nature of the Spurn barrier, the management intent for Policy Unit J (Kilnsea to Spurn Point) is not captured effectively by any of the standard SMP policies. The closest SMP policy that describes the management intent is MR. This would not mean MR in its true sense by constructing new defences, but the policy would be to allow the natural evolution of the spit and to manage its alignment, only intervening where necessary to assist the healing of breaches, if they occur. Road repairs and realignment may also be required to

maintain access to the crucial facilities at Spurn Point, as long as that was sustainable¹⁴. The future behaviour of Spurn Point in relation to sea level rise is not clear (there are several possible scenarios) and it is therefore not possible to be prescriptive concerning the exact nature of the approach that will be taken. Due to this uncertainty the precautionary principle will be applied such that it cannot be assumed that significant effects on the Humber Estuary SAC will not occur as a result of the preferred policy. Therefore Appropriate Assessment is required.

L4.16 The preferred policy for Policy Unit K (Easington Road to Stone Creek) is HTL, however there is recognition that limited managed realignment of defences may occur within this policy unit. The MR aspect of the policy is intended to facilitate the delivery of compensation schemes that have already been identified within the Humber Flood Risk Management Strategy for Epochs 1 and 2¹⁵ and will be developed in the future (as part of a future revision to the Humber Flood Risk Management Strategy) for Epoch 3. Such schemes will enable the habitats and features within the north (Yorkshire) bank of the outer estuary to retreat inland in response to rising sea levels in agreed locations. However, the HTL aspects may lead to coastal squeeze of those elements that cannot retreat inland. Overall it is considered that the preferred policy for Policy Unit K cannot be screened out as unlikely to lead to significant (adverse) effects on the Humber Estuary SAC.

L4.17 Changes to sediment transport into the estuary from the Holderness Coast as a result of the HTL policies for Units B, D, F and H could result in adverse effects on the interest features of the estuary throughout its area (inner, middle and outer parts). Although the vast majority of Unit E will be subject to a policy of NAI, there is a small (approximately 700 m) stretch at Mappleton that will be subject to HTL. The policy for Unit I is HTL (P3¹⁶) for the current defences with NAI elsewhere, across all 3 Epochs. The Policy comments also make it clear that options other than HTL in Epochs 2 and 3 may be considered subject to monitoring of coastal processes, future studies and third party decisions. It is also made clear that limited MR may occur, informed by the Humber Flood Risk Management Strategy. The preferred policies for Policy Units B, D, E (regarding Mappleton), F and H – N are therefore screened in for Appropriate Assessment as a result of their potential for adverse effects on the Humber Estuary SAC.

Humber Estuary SPA

L4.18 The Humber Estuary is designated a Special Protection Area (SPA) for its breeding populations of bittern, avocet, marsh harrier and little tern. It is also designated for its wintering and passage waterfowl. The main roosting and feeding habitats within the outer estuary are at Spurn Bight, Welwick saltmarsh, Pyewipe to Cleethopes, Donna Nook, Tetney Marshes and Grainthorpe Haven and there are also extensive roosting and foraging areas within the inner and middle estuaries. All of these areas are vulnerable to erosion if it outpaces accretion and to sea level rise as this will erode bird habitat and cause birds to concentrate on remaining habitat elsewhere, potentially resulting in an exceedence of carrying capacity (causing displacement out of the estuary entirely) and deterioration in bird condition and survival.

¹⁴ The design of the road (moveable concrete slabs) on the sections most vulnerable to over-topping allows for reinstatement of access without major road repairs

¹⁵ The scale of compensation identified for the adopted Humber Flood Risk Management Strategy is based upon removing maintenance from the flood defences in Policy Unit K, thus allowing them to degrade over time and allow over-topping. This differs from the approach proposed in the HECAG SMP which proposes to maintain those defences. This slight difference in policy is picked up and discussed later in this document.

¹⁶ P3 means that maintenance will be at the current activity level rather than being increased over time

- L4.19 Given the vulnerability of the interest features of the Humber Estuary SPA to coastal squeeze it is difficult to say that there will be no significant effects as a result of the preferred SMP policies for Units B, D, E (with regard to Mappleton), F and H – N for the same reasons that apply to the SAC. Therefore Appropriate Assessment is required for these areas.

Humber Estuary Ramsar site

- L4.20 In addition to habitats, grey seals, lamprey and birds identified in the preceding sections, the Humber Estuary Ramsar site is also designated for its population of Natterjack toad. The intertidal habitats and sand dunes (which are essential to the Natterjack toad population) are vulnerable to erosion.
- L4.21 Given the vulnerability of the interest features of the Humber Estuary Ramsar site to coastal squeeze it is difficult to say that there will be no significant effects as a result of the preferred SMP policies for Units B, D, E (with regard to Mappleton), F and H – N for the same reasons that apply to the SAC and SPA. Therefore Appropriate Assessment is required for these areas.

Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC

- L4.22 Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC is designated for its sand dune complex. These consist of embryonic shifting dunes, shifting dunes with marram grass, fixed dunes with herbaceous vegetation, dunes with sea buckthorn and humid dune slacks. The rapidly-accreting dunes on the seaward sand bars and shingle banks currently make this an important site for research into the processes of coastal development.
- L4.23 The SAC is split between two geographically separate parts of the Lincolnshire coast. One part (Saltfleetby-Theddlethorpe Dunes) lies within Policy Unit N, while the Gibraltar Point element lies within Policy Unit P. Both sites are known to be vulnerable to changes in sedimentation rates along the coast caused by coastal protection schemes. While currently accreting, coastal defence schemes elsewhere may alter this situation when considered within the context of sea level rise.
- L4.24 The preferred policy within Policy Unit N is HTL in all epochs, however there is recognition that limited managed realignment of defences may occur within this policy unit. The preferred policy within Policy Unit P is HTL for epochs 1 and 2. The policy in epoch 3 is conditional, either HTL or MR, depending on the results of monitoring and research into climate change, shoreline response and the role of defences. As such, the HTL policies in Units N and P cannot be described as being unlikely to lead to significant effects on the SAC. This is because, as time progresses it is unlikely that artificial replenishment of sediment up-drift at present day volumes or onshore transport of natural sediment will counterbalance the rate of sea level rise. This in turn means that a reduction in the extent of dune habitat is likely.
- L4.25 Moreover, a HTL policy in Policy Unit O (and to a lesser extent those for the Holderness Coast (Units B, D, E (with regard to Mappleton), F and H)) could cause a reduction in sediment moving south towards the dunes at Gibraltar Point. This is because coastal processes supplying sediment to other coastlines would begin to be affected as the defence line is held and the quantity of sediment available for long-shore transport is reduced by sea level rise.
- L4.26 The preferred policies for Policy Units N – P (and to a lesser extent Units B, D, E (with regard to Mappleton), F and H), are therefore screened in for Appropriate Assessment in the following

chapter as a result of their potential for adverse effects on the Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC.

Gibraltar Point SPA

- 4.26.1 Gibraltar Point SPA is designated for its important breeding little terns, wintering waterfowl and passage waders that use the mixture of sand dune, salt marsh and inter-tidal habitats. Gibraltar Point is known to be vulnerable to changes in sedimentation rates along the coast caused by coastal protection schemes further north.
- L4.27 Gibraltar Point SPA lies within Policy Unit P. The preferred policy within this Unit is HTL in all epochs. This policy in Unit P cannot be described as being unlikely to lead to significant effects on the SPA since as time progresses it is unlikely that artificial replenishment of sediment up-drift at present day volumes or onshore transport of natural sediment will counterbalance the rate of sea level rise, which would mean a reduction in the extent of dune habitat.
- L4.28 Moreover, a HTL policy in Policy Units N and O (and to a lesser extent those for the Holderness Coast (Units B, D, E (with regard to Mappleton), F and H)), may cause a reduction in sediment moving south towards Gibraltar Point since coastal processes supplying sediment to other coastlines would begin to be affected as the defence line is held and the quantity of sediment available for long-shore transport is reduced by sea level rise.
- L4.29 The preferred policies for Policy Units N – P (and to a lesser extent Units B, D, E (with regard to Mappleton), F and H), are therefore screened in for Appropriate Assessment in the following chapter as a result of their potential for adverse effects on the Gibraltar Point SPA.

Gibraltar Point Ramsar site

- 4.29.1 Gibraltar Point Ramsar site is designated for its dune communities, bird populations and an assemblage of wetland invertebrate species of which eight species are listed as rare in the British Red Data Book and a further four species listed as vulnerable. This is associated with the freshwater marsh containing sedges *Carex* spp., rushes *Juncus* spp., and ferns, including adder's-tongue fern *Ophioglossum vulgatum*. The site is also the most northerly example of nationally rare saltmarsh/dune communities containing sea heath *Frankenia laevis*, rock sea lavender *Limonium binervosum* and shrubby seablite *Suaeda vera*.
- L4.30 Gibraltar Point Ramsar site has a similar boundary to Gibraltar Point SPA lying within Policy Unit P. The likely significant effects on the Ramsar site will be similar to those on the SPA, being associated with coastal squeeze and reduced longshore sediment inputs.
- L4.31 The preferred policies for Policy Units N – P (and to a lesser extent Units B, D, E (with regard to Mappleton), F and H), are therefore screened in for Appropriate Assessment in the following chapter as a result of their potential for adverse effects on the Gibraltar Point Ramsar site.

The Wash & North Norfolk Coast SAC / The Wash SPA & Ramsar site

- L4.32 Although these three sites have slightly different boundaries and different interest features, they are considered collectively in this section in order to minimise repetition.

- L4.33 The Wash and North Norfolk Coast is one of the most diverse coastal systems in Britain. This diversity is largely dependent on physical processes that dominate the natural system; consequently the vulnerability of habitats is linked to changes in the physical environment. In particular, changes in the sediment budgets are known to be a risk to these habitats. At present activities which alter the sediment characteristics include dredging and coastal protection works, but changes in the quantity of sediment entering the system from the Lincolnshire and East Yorkshire coasts will also have important implications for the interest features of the area.
- L4.34 As with Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SPA, the HTL policy in those Policy Units between the Humber Estuary and The Wash (i.e. Units N - P), and to a lesser extent those for the Holderness Coast (Units B, D, E (with regard to Mappleton), F and H), may cause a reduction in sediment moving south towards the dunes (and ultimately The Wash) since coastal processes supplying sediment to other coastlines would begin to be affected as the defence line is held and the quantity of sediment available for long-shore transport is reduced by sea level rise.
- L4.35 The preferred policies for Policy Units N – P are therefore screened in for Appropriate Assessment in the following chapter as a result of their potential for adverse effects on The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar site.

Inner Dowsing, Race Bank and North Ridge pSAC

- L4.36 The Inner Dowsing, Race Bank and North Ridge pSAC is not yet officially designated. However, on the basis that it is likely to become designated during the SMP period we have considered it in this HRA. The pSAC is a marine SAC located approximately 1.5km off the South Lincolnshire coast at its closest and crossing the 12 nautical mile limit and is thus partly inshore and partly offshore. It is being proposed for designation based upon its sub-tidal sandbanks and reefs¹⁷. The area encompasses a wide range of sandbank types (banks bordering channels, linear relict banks, sinusoidal banks with distinctive subsidiary banks), associated channels and biogenic reef of *Sabellaria spinulosa*¹⁸.
- L4.37 To the south-west the pSAC abuts The Wash & North Norfolk Coast SAC although the internationally important habitats within this part of the pSAC are its reefs. The main sub-tidal sandbanks are located much further out to sea, approximately 14km off the coast. As such, it is considered that the reefs are not vulnerable to impacts from coastal defences within the SMP area and the sub-tidal sandbanks are located sufficiently far out to sea that any changes in sediment movement along the South Lincolnshire coast would be unlikely to lead to a significant adverse effect.
- L4.38 The draft conservation objectives and advice on operations regarding the pSAC identifies aggregate dredging, demersal trawling, benthic dredging and installation of renewables infrastructure as the key risks to sediment within the sub-tidal sandbanks. Natural England has commented that the continued dredging for material for beach nourishment at Skegness will necessitate dredging of marine aggregate from Area 481 at Inner Dowsing.

¹⁷ All information regarding the pSAC, including a map of habitat distribution, is available in the JNCC/Natural England document 'Special Area of Conservation (SAC): Inner Dowsing, Race Bank and North Ridge pSAC Selection Assessment' Version 3.0 (10th November 2009) and in the JNCC/Natural England document 'Offshore Special Area of Conservation (SAC): Inner Dowsing, Race Bank and North Ridge – Draft Conservation Objectives and Advice on Operations' Version 2.0 (September 3rd 2009)

¹⁸ Colin Holm (Natural England) in an email to Jeremy Pickles (East Riding of Yorkshire Council) of 18/05/10

- L4.39 Policy Unit O presently states that: ‘Currently, beach nourishment occurs via the ongoing Lincshore scheme and this forms an important part of the defences. Beach nourishment can continue under this policy as currently it contributes effectively towards the Hold the Line policy’. It may therefore be concluded that a policy of Hold the Line at Skegness may require continued extraction of sand from Area 481 for beach nourishment. However, it is understood that the Lincshore scheme is not currently considered by Natural England/JNCC to be having a damaging effect on the pSAC and this HRA has therefore not identified any specific effects in relation to the draft conservation objectives of the pSAC as a result of the policy selection for Unit O.
- L4.40 It has therefore been possible to screen out all SMP policies as being unlikely to lead to significant effects upon Inner Dowsing, Race Bank and North Ridge pSAC and the site is therefore not considered further in this report.

Summary of Screening

- L4.41 It has been concluded that significant effects on internationally important wildlife sites from the preferred policy in the following Policy Units cannot be described as unlikely and therefore require Appropriate Assessment.

Table 4.1: Summary of likely significant effect screening

Internationally Designated wildlife site	Policy Unit screened in for Appropriate Assessment	Issue
Flamborough Head SAC	None	-
Flamborough Head to Bempton Cliffs SPA	None	-
Hornsea Mere SPA	None	-
Humber Estuary SAC	B, D, E (regarding Mappleton), F, H -N	Coastal squeeze, disturbance and disruption of sediment processes
Humber Estuary SPA	B, D, E (regarding Mappleton), F, H -N	Coastal squeeze, disturbance and disruption of sediment processes
Humber Estuary Ramsar site	B, D, E (regarding Mappleton), F, H -N	Coastal squeeze, disturbance and disruption of sediment processes
Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC	N – P (and to a lesser extent B, D, E (regarding Mappleton), F and H)	Coastal squeeze, disturbance and disruption of sediment processes
Gibraltar Point SPA	N – P (and to a lesser extent B, D, E (regarding Mappleton), F and H)	Coastal squeeze, disturbance and disruption of sediment processes
Gibraltar Point Ramsar site	N – P (and to a lesser extent B, D, E (regarding Mappleton), F and H)	Coastal squeeze, disturbance and disruption of sediment processes
The Wash & North Norfolk Coast SAC	N – P (and to a lesser extent B, D, E (regarding Mappleton), F and H)	Disruption of sediment processes
The Wash SPA	N – P (and to a lesser extent B, D, E (regarding Mappleton), F and H)	Disruption of sediment processes
The Wash Ramsar site	N – P	Disruption of sediment processes
Inner Dowsing, Race Bank and North Ridge pSAC	None	-

L4.42 The Appropriate Assessment is the subject of the next seven Chapters.

L5 Appropriate Assessment: Humber Estuary SAC

- L5.1 This Chapter documents the Appropriate Assessment of the Flamborough Head to Gibraltar Point SMP with regard to those Policy Units for which the preferred policy could not be screened out as ‘unlikely to lead to significant effects’ on the Humber Estuary SAC. Note that this chapter appraises the revised policies as they stand in August 2010, incorporating the amendments which it has been agreed with Natural England are necessary to enable the delivery of measures to avoid, mitigate or compensate for adverse effects.
- L5.2 Since Easington Lagoons and Spurn Point are distinct features within the three internationally important wildlife sites that cover the Humber Estuary and will respond differently from the rest of the estuary to impacts as a result of their unique characteristics, they are dealt with separately from the remainder of the estuary. The Humber Flood Risk Management Strategy is referenced several times in this and subsequent chapters. The current Flood Risk Management Strategy is available at <http://www.grdp.org/homeandleisure/floods/31704.aspx>. Where reference to the Appropriate Assessment of the Humber Flood Risk Strategy is made this relates to the Appropriate Assessment of the emerging revised Strategy that will replace the current Strategy in due course.
- L5.3 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter 14 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur. Chapters 15 and 16 then address amendments that have been made to the final SMP policy in order to facilitate compensatory habitat creation triggered by those residual adverse effects. It should be noted that the ‘no alternatives’ and IROPI arguments that need to be made as part of the ‘IROPI case’ to the Secretary of State associated with the provision of compensatory habitat will be set out in a separate document.

Humber Estuary SAC as a whole (including Inner and Middle Estuaries)

- L5.4 Before undertaking a detailed evaluation of the impacts and effects of the SMP on the components of the outer Humber Estuary, it is important to consider impacts on the integrity of the entire SAC as a single functional unit. This section is specifically intended to examine impacts on the inner and middle estuaries as they will arise from the works in the outer estuary associated with the SMP.
- L5.5 The amendments that were made to SMP policy in 2010 stemmed in part from an identification that the following adverse effects would otherwise result on the Humber Estuary SAC as a whole when the SMP was considered in combination with the Humber Flood Risk Management Strategy:
- Direct habitat loss due to coastal squeeze during Epochs 1-3 within the outer estuary where an HTL policy is envisaged and within the inner/middle estuaries due to flood defence works under the Humber Flood Risk Management Strategy;

- Reduction in the erosion of material from the Holderness Coast (unlikely to become significant until at least Epoch 3), meaning that less material enters the estuary system (including the inner and middle estuaries) to replace that which is eroded or inundated due to sea level rise. This will occur through three pathways:
 - Through a direct reduction in the erosion of material behind the defences;
 - Through the retention of material behind and within the defences themselves; and
 - Through the accumulation of material updrift of the defences.
- L5.6 These are considered in more detail below. Details of habitat quantities are drawn from the Appropriate Assessment of the revision to the Humber Flood Risk Management Strategy. However, when reading these quantitative estimates it should be noted that the revision to the Humber Flood Risk Management Strategy is still in progress, that the Humber Flood Risk Management Strategy only covers a 50-year period as opposed to the 100 year timescale of the SMP and that there are small differences in policy between the SMP and current Humber Flood Risk Management Strategy (namely relating to the maintenance in defences in Unit K). Therefore the quantities cited in the following section can only be considered broadly indicative rather than precise.

Direct habitat loss due to coastal squeeze and defence footprint

- L5.7 An increased standard of flood defence may involve an increase in defence footprint (both permanent and temporary during works). In addition, as the sea level rises and erosion increases the mudflats, sandflats, saltmarsh and sand dunes of the undefended parts of the estuary (including the inner and middle estuaries) would ordinarily migrate inland thus preserving the overall structure and function of these habitats and the integrity of the SAC. In defended locations this will not occur as the defences themselves will prevent such migration.
- L5.8 The Appropriate Assessment of the Humber Flood Risk Management Strategy (by Halcrow on behalf of the Environment Agency, 2009) calculates that a total of approximately 790 ha of habitat within the estuary as a whole will be lost to coastal squeeze over the 50-year Strategy period (plus a further 40 ha of direct losses due to the defences themselves). Approximately 230 ha of losses due to coastal squeeze (and approximately 10 ha of direct losses due to the defences themselves) will be located within the outer estuary and can therefore be considered to be a result not only of the Humber Flood Risk Management Strategy but also the SMP policy for Units I to N during SMP Epochs 1 and 2. Moreover, the SMP policy for Unit K involves the maintenance of defences (as opposed to the Humber Flood Risk Management Strategy which states that maintenance will be withdrawn). It is possible therefore that the SMP would result in a small additional increase in habitat loss if the defence footprint was increased. However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint).
- L5.9 The Humber Flood Risk Management Strategy does not cover SMP Epoch 3; however, it is likely that the losses in Epoch 3 will be at least as great as those that will occur during the two preceding Epochs. Due to the increased rate of sea level rise during Epoch 3, losses during Epoch 3 are in fact likely to be greater.
- L5.10 This would clearly constitute an adverse effect on the integrity of the SAC through loss of intertidal mudflat and sandflat, saltmarsh (both glasswort beds and Atlantic salt meadows), sand dunes and (as accretion of intertidal sandflat in Policy Unit N potentially shifts to net

erosion during Epoch 3) loss of habitat for the grey seal colony at Donna Nook and it was identified that if this could not be avoided SMP policy would need to make provision for the delivery of compensatory habitat through local MR. This is covered further in Chapters 15 and 16.

- L5.11 A breakdown of impacts and effects in each part of the outer estuary and on each designated feature of the SAC is provided later in this chapter.

Loss of sediment locked behind the defences of the Holderness Coast

- L5.12 Townend and Whitehead (2003)¹⁹ estimate the net marine input of sediment to the Humber Estuary as 100 tonnes per tide while the net fluvial input is 335 tonnes per tide. However, it was also acknowledged that the uncertainty in this figure (Townend and Whitehead, 2003) is of the order of 50-1500 tonnes per tide. Data from an earlier (1998) piece of work referenced in Natural England's Regulation 33 report on the Humber Estuary²⁰ notes that '*The majority of suspended sediment is from the sea, with over 1,500 tonnes carried in per tide, compared to an average of 320 tonnes from riverine sources (Environment Agency, 1998). It has been estimated that up to 1.26 million tonnes of sediment may be present in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 tonnes exported to the sea (Environment Agency, 1998). The deposited sediments provide essential material to maintain the mudflats, sandflats and saltmarsh, and concentrate where the River Trent enters the estuary and on the extensive intertidal flats of the outer estuary*'. The integrity of the entire SAC therefore clearly depends upon a continued supply of sufficient sediment from both fluvial and marine, including the Holderness Coast.
- L5.13 It is therefore clear that sediment from marine sources (including a significant proportion from the Holderness Coast) is of importance in preserving the integrity of the SAC, with regard to saltmarsh, sandflats, mudflats and sand dunes of the outer, inner and middle estuaries and with regard to the reedbeds that are concentrated in the middle and inner estuaries.
- L5.14 According to an Appropriate Assessment report compiled in 2003 for the Sand-le-Mere coastal defences²¹, approximately 102,750 m³/yr of sediment is retained behind, or updrift of, the defences along the Holderness Coast. It is further stated that approximately 25% of this is of sufficient particle size to form sand dunes. The report does stress that this is a very approximate indication.
- L5.15 Under the assumption that all the sediment retained by the existing structures along the Holderness Coast would otherwise enter the Humber Estuary, the Sand-le-Mere report comments that it is possible to estimate that the presence of the existing structures prevents some 3.4% of the overall potential volume from entering the estuary. This has been calculated utilising the estimated amount of sediment entering the Humber from the Holderness Coast provided by Binnie Black and Veatch and the Environment Agency²², which was 3 million m³ per annum. The previous SMP (SMP1) estimated the total volume of sediment entering the estuary from the Holderness Coast at 2.5 million m³ per annum.

¹⁹ Townend, I. and Whitehead, P., 2003, A preliminary net sediment budget for the Humber Estuary, *The Science of the Environment*, 314-316, 755-767

²⁰ English Nature. 2002. The Humber Estuary European Marine Site. English Nature Advice Under Regulation 33(2) of the Conservation (Natural Habitats &c) Regulations 1994

²¹ Royal Haskoning. 2003. Proposed Coast Protection Works at Sand-le-Mere. Information for an Appropriate Assessment. Unpublished report for East Riding of Yorkshire Council

²² Binnie, Black & Veatch and Environment Agency. 2000. The Humber Estuary Geomorphological Studies (Stage 2), Supporting Reports and Papers, Volume 2.

- L5.16 The demand for sediment within the Humber as a result of relative sea level rise is estimated to be around 300,000 m³/year per millimetre rise in sea level by HR Wallingford (2003)²³. If the rate of sea level rise increases to over 1cm per year by 2108 this would put demand at 3 x 10⁶ m³/year, slightly more than the combined cohesive and non-cohesive sediment output (2.7 x10⁶ m³/year) from Holderness at present.
- L5.17 Adopting a policy of HTL for Policy Units B (Bridlington), D (Hornsea), E (partially, with regard to Mappleton), F (Withernsea) and G (Dimlington & Easington Gas Terminals) without the amendments that have been made to facilitate potential sediment release in response to sea level rise (these amendments are discussed in Chapter 14) would therefore continue to ensure that up to 3.4% of the overall potential volume of sediment could fail to reach the estuary²⁴. While this is a small proportion, it would represent a large volume and its continued absence would be likely to become increasingly important as erosion rates within the estuary increased over the SMP timescale (during Epoch 3), particularly when this is considered cumulatively with habitat losses throughout the estuary due to coastal squeeze and interruptions in long-shore sediment transport due to the development of promontories (see below).

Interruption to long-shore sediment transport due to emerging promontories

- L5.18 If sections of the Holderness Coast are prevented from eroding due to an HTL policy, this will mean that over time a system of bays (in those sections where erosion has been allowed) and promontories (in those sections where it has been prevented) will develop. The promontories will themselves act as sediment traps thus further disrupting the supply of sediment to the Humber Estuary SAC as a whole, even from sections of coast that are allowed to erode.
- L5.19 It is difficult to estimate when these embayments and promontories will become significant enough to prevent significant quantities of sediment from reaching the Humber Estuary (particularly since the judgment as to what constitutes a 'significant' amount would need to be made within the context of a probable increase in demand for sediment due to other impacts in the estuary arising from coastal squeeze). However, the sediment process report indicates that this might happen during Epoch 3 without the amendments that have been made to facilitate potential sediment release in response to sea level rise (these amendments are discussed in Chapter 13). There are no predictions available concerning the actual quantities of sediment that may be trapped since there are too many uncertainties in existing understanding of shoreline processes and behaviour to render predictions accurate. However, it clearly could not be concluded that the trapping of sediment by these emerging promontories will not have an adverse effect on the SAC (saltmarsh, sandflats, mudflats and sand dunes of the outer, inner and middle estuaries and with regard to the reedbeds that are concentrated in the middle and inner estuaries) and amendments to policy were therefore required to allow for additional sediment release (see Chapter 14).

In combination effects other than the Humber Flood Risk Management Strategy on the estuary as a whole

- L5.20 The impacts of the SMP have already been considered 'in combination' with the Humber Flood Risk Management Strategy. There are however a series of additional projects and plans that

²³ HR Wallingford 2003. Humber Estuary Shoreline Management Plan, Phase 2 Coastal behaviour from Easington to Mablethorpe: Summary report for HESMP2 by HR Wallingford and BGS. Report EX 4846

²⁴ Note that this relates to the continued withholding of potential sediment rather than an actual net reduction in sediment supply compared to the current baseline; in absolute terms, the volume of sediment supplied downdrift to the Humber Estuary will be greater than is currently the case due to increased erosion rates.

will be delivered within the East Yorkshire, North East Lincolnshire and East Lindsey areas and which could also contribute to an 'in combination' effect on the Humber Estuary SAC as a whole either by exacerbating an adverse effect of the SMP or by introducing new adverse effects that could occur at the same time as the implementation of the SMP and thus work cumulatively on the SAC:

- The Helius Energy biomass plant at Stallingborough, the Abengoa bio-ethanol plant at Stallingborough and the Vireol bio-ethanol plant at Grimsby – these could result in adverse effects through an increase in atmospheric nitrogen emissions and therefore deposition within the estuary, which would in turn contribute to eutrophication;
- A new 20,000 seat Grimsby town football stadium at Great Coates – although a major project on the south bank of the estuary, no mechanism for any adverse effect has been identified.
- Grimsby Proposed 'Roll on –Roll off' ferry berth – this project may involve direct habitat loss and disruption to sediment movements around the outer estuary due to dredging to support the berth;
- East Yorkshire Local Development Framework and East Lindsey LDF – since both of these involve the delivery of new housing it is possible that this would be accompanied by an increased population. Since the Humber Estuary represents a significant recreational resource in the area it is also possible that this increased population could contribute cumulatively to adverse effects in the estuary by increasing habitat damage;
- Offshore windfarms - Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula. This will operate cumulatively with those SMP policies which will lead to a reduction in sediment supply to Spurn and the Humber Estuary SAC from the Holderness Coast;
- Iota Dredge – This project involves a 4.5 million m³ capital dredge and 1.5 million m³ maintenance dredge. However, all the sediment will remain in the estuary such that it will not result in the removal of additional sediment that would otherwise be available to supply the estuary.

L5.21 The same amendments to policy which address the impacts of the SMP in isolation will however also address its contribution to these 'in combination' effects (see Chapter 14). .

The sections of the outer estuary

L5.22 Having examined the adverse effects on the Humber Estuary SAC as a whole (including the inner and middle estuaries), the remaining sections of this chapter focus specifically on the impacts of the SMP on each discrete area of the outer Humber Estuary and on each SAC interest feature present within those areas.

L5.23 Flood defences constrain the naturally dynamic nature of the Humber estuary along the majority of its length, with these structures restricting the development of intertidal mudflat and saltmarsh. The most extensive intertidal areas are the mudflats at Spurn Bight on the north bank, and the sandflats between Cleethorpes and Donna Nook on the south. Additionally, there are a number of less extensive muddy embayments located at Pyewipe, near

Immingham. Such intertidal areas are fundamental to the ecology of the estuary and provide an important food source for internationally important numbers of waders and wildfowl, together with commercial fish species.

Spurn Point and Spurn Bight (Policy Units J and K)

- L5.24 The peninsula of Spurn Head extends from Kilnsea Warren, at the southern end of the Holderness cliffs, and forms a barrier extending 5 km into the mouth of the Humber Estuary. The southern end of the barrier terminates abruptly in the Humber deep-water channel. Immediately west of Spurn Point lies an extensive area of intertidal mudflat and sandflat called Spurn Bight. Welwick saltmarshes lies immediately landward of the Bight.
- L5.25 The Spurn Peninsula itself is primarily of international interest for supporting a successional range of sand dune stages (embryonic dunes → white dunes → grey dunes → dunes with sea buckthorn) and (on its western side) fringing saltmarsh.

South Coast of Humber Estuary from Immingham to Mablethorpe (Policy Units L- N)

- L5.26 The intertidal flats of the outer estuary are predominantly sandy due to the high energy environment and larger component of marine sediment. These highly mobile areas support species such as polychaete worms, amphipod crustaceans, and the sand mason worm. Areas of intertidal muddy sand occur in the more sheltered areas including the south bank of the outer estuary from Cleethorpes to Donna Nook where sediment conditions are relatively stable. These areas are colonised by polychaetes and bivalve molluscs.
- L5.27 Fringing saltmarsh habitat is found throughout the Humber Estuary. On the south bank there are notable areas of saltmarsh near Tetney where the coast is sheltered by offshore banks, and south of Donna Nook where they front the North Lincolnshire coastal dunes systems and are again sheltered by extensive intertidal flats and offshore banks. Saltmarsh additionally fronts the dune complex between Saltfleet and Theddlethorpe, although elsewhere within the Humber, the saltmarsh is confined to a discontinuous narrow fringe in front of sea walls or tidal defence structures.
- L5.28 The Cleethorpes shore is characterised by dry sand ridges, muddy basins and backed in part by low dunes and as such are distinct from the more muddy intertidal mudflats within the main body of the estuary. The Tetney section of the coast centres on the outfall of the Louth Canal and includes soft mudflats, sand flats and sandy ridges, backed by saltmarsh and dune.
- L5.29 The Grainthorpe, Donna Nook and Saltfleet reach comprises an extensive intertidal area dominated by fine sand and areas of mud and shingle, backed by saltmarsh, dune and buckthorn.

Impacts on the Outer Estuary: Spurn Point (Policy Unit J)

- L5.30 The Spurn Peninsula comprises two distinct sections; a series of connected “islands” formed by the accumulation of coarse sediment behind and protected by the moraine ridges and a barrier connecting this feature to the Holderness cliff-line. An important difference between these two sections is that the barrier is free to erode and retreat, whereas the “island” is protected.

- L5.31 Key controls on the dynamic behaviour of Spurn are the supply of coarse sediment generated from the retreat of the Holderness cliffs and wave energy. Spurn Point receives considerable coarse sediment from the southern part of the Holderness cliffs (from Barmston southwards). Dunes on the barrier form sand blown along the eastern side of the barrier.
- L5.32 Spurn is a dynamic barrier that is progressively lengthening and realigning. Historical behaviour includes westward retreat (roll-over), shoreface erosion, re-alignment and temporary breaching. Barrier retreat is controlled by the relative significance of overtopping and overwashing wave events. If the crest height becomes low relative to wave run-up, then the rate of overtopping will increase and the beach crest will rise, reducing the potential for further overwashing. The presence of mudflat sediments and peat beneath the sand and gravel ridge suggests that the barrier has rolled-over into the estuary.
- L5.33 In recent years the beach and dune ridge at the northern end of the peninsula has narrowed and is frequently overwashed during storm events. It is believed that the mid-19th century coastal defences have inhibited the roll-over process, limiting the transfer of sediment onto the western shore. Failure to achieve westward roll-over and barrier migration over the last 150 years has meant that the barrier is now in an unstable position.
- L5.34 The preferred policy for Policy Unit J (Kilnsea to Spurn Point) is MR with the possibility of NAI in Epochs 2 and 3. As such, Spurn will be allowed to continue to evolve naturally as it has done historically and the only intervention will be breach repair (provided this remains a sustainable solution to maintain road access). The MR policy for Unit J will allow the overall quantity of sand dune habitat to be maintained; however, the relative abundance of the four successional dune stages (embryonic dunes → white dunes → grey dunes → dunes with sea buckthorn) are likely to change as the succession process on the Spurn peninsula is restarted. Since this process will ultimately preserve the overall successional range within the estuary, a judgment of no adverse effect can be made.
- L5.35 The process of realignment of the Spurn peninsula may result during Epochs 2 and 3 in some reduction in the extent of intertidal mudflat at Spurn Bight, which lies behind the peninsula. These mudflats and sandflats are internationally important habitats in themselves. However, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J, provided that repair of breaches to the Peninsula does not involve encroachment onto the mudflats of the Bight, as such encroachment would exacerbate coastal squeeze.

Sediment movement

- L5.36 For the purposes of this Appropriate Assessment and the determination of adverse effects below, we have utilised the sediment process information collected to support the SMP. It should be noted that this uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, the SMP Action Plan must include measures to further investigate and resolve this issue such that any revisions to policy can be made following the obtaining of further data. This is covered further in Chapter 14.
- L5.37 There would be potential for a reduction in southward sediment drift from the Holderness Coast in Epoch 3 under the preferred policy scenario if amendments had not been made to allow for additional sediment release in Epoch 3. If such release did not occur it would have implications for the integrity of the Spurn peninsula. The future behaviour of Spurn will be critically dependent on:

- Longshore coarse sediment supply from the Holderness cliffs; and
 - Wave energy inputs arriving at the shoreline.
- L5.38 Although an HTL policy will prevent erosion in Policy Units B, D, E (with regard to Mappleton), F and H, sediment will continue to be supplied to Spurn and Spurn Bight over the SMP timeframe as erosion rates will accelerate along the undefended sections of the Holderness cliffs due to sea level rise. During Epoch 2, the sediment process report concludes that the defended areas preventing erosion will increasingly begin to trap sediment on their updrift side, but that erosion would accelerate on their downdrift side. The net effect would therefore be that there would be no significant impact on the transfer of sediment southwards from the Holderness Coast to Spurn. During Epoch 3, the potential for interruption to longshore transport will increase as the defended sections begin to protrude relative to the eroding undefended areas. The transport of material southwards is expected to continue as sea level rise would increase the erosion rate thus helping to maintain the volume of coarse sediment for transport, but some decrease could occur. If this decrease in sediment supply occurred during Epoch 3, the risk of breaches of the Spurn peninsula would increase.
- L5.39 The MR policy for Policy Unit J is intended to partially address this issue of avoiding breaches to the peninsula, with intervention (generally through softer engineering solutions, such as sediment nourishment) to minimise the risk of breaches and maintain the integrity of the barrier, for as long as it proves sustainable to do so. However, the MR policy as it is written will only provide small scale minimal intervention repair rather than large scale sediment nourishment schemes. It would therefore not cancel out the adverse effect of the preferred policies for Units B, D, E (with regard to Mappleton), F and H on the Spurn peninsula during Epoch 3. Further wording was therefore identified as being necessary for incorporation into policy to cover the issue of a reduction in sediment supply from the Holderness Coast. These amendments are discussed in Chapter 14.
- L5.40 In addition to receiving sediment from the Holderness coast, Spurn is probably a source of sediment for the mobile sand sheets within the Humber Estuary. The barrier also provides shelter for the extensive mudflats of Spurn Bight within the estuary that have accreted on its landward side. It also affords a limited degree of shelter from waves from the north-east to the frontages of Cleethorpes and Grimsby on the south bank of the estuary.
- L5.41 Shoreface erosion and longshore transport provides coarse sediment to the Humber mouth sediment sinks/stores (the Binks, New Sand Hole and mobile sand sheets). However, the MR preferred policy for Policy Unit J should not interfere with natural sediment transport from the peninsula.

Uncertainty

- L5.42 There remains uncertainty over how Spurn Point will respond to rising sea levels, particularly with regard to breaching. The tendency for overwashing at vulnerable locations along its length is likely to increase into the future, leading to eventual breaching. However, as Spurn is essentially the raised edge of the Spurn Bight intertidal flats, one view is that a breach would not alter the overall shape of the Humber Estuary as continued longshore sediment supply should ensure that breaches would eventually heal. However, a different view has been presented by the East Yorkshire Coastal Observatory (undated) who suggested that the Humber will use any breach channel to drain into the North Sea causing rapid erosion and possible loss of the entire peninsula. Spurn Point, which will have become an island, starved of sand and would rapidly erode. Its ultimate survival in that situation would be dependent upon

the time taken for the peninsula to reform, which it could only do if adequate sediment were available. Loss of the Spurn Point and Binks system could result in major changes to the Humber mouth.

Impacts on the Outer Estuary: Spurn Bight (Policy Unit K)

- L5.43 The defence of Spurn Bight itself (and the remainder of the north bank of the outer estuary) will be decided by the preferred policy for Policy Unit K. The SMP policy for all Epochs is HTL. It was recognised that this would have an adverse coastal squeeze effect during all 3 Epochs on the intertidal mudflat and saltmarsh of Spurn Bight and Welwick Marsh and if this could not be avoided amendments would need to be made to policy to allow for local MR within Unit K which would facilitate compensatory habitat provision. This is covered in more detail in Chapters 15 and 16.
- L5.44 The SMP policy for Unit K involves the maintenance of defences (as opposed to the Humber Flood Risk Management Strategy which states that maintenance will be withdrawn). It is possible therefore that the SMP will result in a small additional increase in habitat loss if the defence footprint is increased and policy wording was devised for the SMP or Action Plan to address this point (see Chapter 14). However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint).
- L5.45 The potential for an adverse effect also needs to be considered within the context of the disturbance effects that are likely to result from the allocations made for development through the East Yorkshire Local Development Framework (LDF), Easington to Paull gas pipeline and offshore windfarm projects planned for the Humber Estuary and the coastal squeeze effects that the Appropriate Assessment for the Humber Flood Risk Management Strategy (2009) has identified as occurring within the inner and middle parts of the estuary over the same time period. These would lead to an adverse effect 'in combination' with the Flamborough Head to Gibraltar Point SMP during Epoch 1 without mitigation being built into SMP policy.
- L5.46 The impacts of SMP policy on Spurn peninsula and Spurn Bight over the three epochs of the SMP as a result of an MR policy for Policy Unit J and an HTL policy for Unit K are set out in Table 5.1, overleaf.

In combination effects on Policy Units J and K

Epoch 1

- L5.47 There are a series of additional projects and plans that will be delivered within East Yorkshire and which require consideration regarding an 'in combination' effect on the Humber Estuary SAC within Units J and K:
- Humber Flood Risk Management Strategy – particularly those proposals for the inner and middle estuaries which will result in coastal squeeze and direct landtake for defences. In addition, the SMP policy for Unit K involves the maintenance of defences (as opposed to the Humber Flood Risk Management Strategy which states that maintenance will be withdrawn). It is possible therefore that the SMP will result in a small additional increase in habitat loss if the defence footprint is increased. However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in

defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint);

- East Yorkshire Local Development Framework - particularly recreational trampling associated with the increased population occupying the 17,850 dwellings to be developed under the Core Strategy from 2011 – 2026; and
- Windfarms: potential to be proposed in various locations. Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula.

L5.48 However, the contribution of the SMP to any adverse effect can be removed through appropriate mitigation for its own impacts. These are considered further in Chapter 14.

Epochs 2 and 3

L5.49 No 'in combination' assessment is possible for Epochs 2 and 3 since no projects and plans that will come on line during those Epochs are sufficiently developed at this stage.

Table 5.1: Impacts of SMP policy on Spurn peninsula and Spurn Bight over the three epochs of the SMP as a result of a MR policy for Policy Unit J and HTL for Policy Unit K in the absence of mitigation.

Designated international interest feature on the Spurn peninsula or at Spurn Bight	Effect from the Flamborough Head to Gibraltar Point SMP		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Habitats			
Embryonic shifting dunes	<p>No adverse effect</p> <p>No material change is likely to occur during Epoch 1</p>	<p>No adverse effect</p> <p>In the intermediate term, this habitat can be expected to increase as Spurn peninsula realigns itself and restarts the sand dune succession.</p>	<p>Possible adverse effect</p> <p>The policy of MR of the peninsula will enable partial maintenance of this habitat in the long term but will not provide for the scale of sediment inputs that may be necessary to compensate for the loss of sediment from the Holderness Coast.</p>
Shifting dunes along the shoreline with marram grass <i>Ammophila arenaria</i> ('white dunes')	<p>No adverse effect</p> <p>No material change is likely to occur during Epoch 1</p>	<p>No adverse effect</p> <p>In the intermediate term, this habitat can be expected to decrease at the expense of embryonic shifting dunes as Spurn peninsula realigns itself and restarts the sand dune succession.</p> <p>However, this is part of the natural sand dune succession process and is therefore not considered to be an adverse effect.</p>	<p>Possible adverse effect</p> <p>The policy of MR of the peninsula will enable partial maintenance of this habitat in the long term but will not provide for the scale of sediment inputs that may be necessary to compensate for the loss of sediment from the Holderness Coast.</p>

Designated international interest feature on the Spurn peninsula or at Spurn Bight	Effect from the Flamborough Head to Gibraltar Point SMP		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Fixed dunes with herbaceous vegetation ('grey dunes')	<p>No adverse effect</p> <p>No material change is likely to occur during Epoch 1</p>	<p>No adverse effect</p> <p>In the intermediate term, this habitat can be expected to decrease at the expense of 'white dunes' as Spurn peninsula realigns itself and restarts the sand dune succession.</p> <p>However, this is part of the natural sand dune succession process and is therefore not considered to be an adverse effect.</p>	<p>Possible adverse effect</p> <p>The policy of MR of the peninsula will enable partial maintenance of this habitat in the long term but will not provide for the scale of sediment inputs that may be necessary to compensate for the loss of sediment from the Holderness Coast.</p>
Dunes with sea buckthorn <i>Hippophae rhamnoides</i>	<p>No adverse effect</p> <p>No material change is likely to occur during Epoch 1</p>	<p>No adverse effect</p> <p>In the intermediate term, this habitat can be expected to decrease at the expense of 'grey dunes' as Spurn peninsula realigns itself and restarts the sand dune succession.</p> <p>However, this is part of the natural sand dune succession process and is therefore not considered to be an adverse effect.</p>	<p>Possible adverse effect</p> <p>The policy of MR of the peninsula will enable partial maintenance of this habitat in the long term but will not provide for the scale of sediment inputs that may be necessary to compensate for the loss of sediment from the Holderness Coast.</p>

Designated international interest feature on the Spurn peninsula or at Spurn Bight	Effect from the Flamborough Head to Gibraltar Point SMP		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Salicornia and other annuals colonising mud and sand (i.e. early succession saltmarsh)	<p>Adverse effect</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>	<p>Adverse effect</p> <p>The western side of the Spurn peninsula is lined with saltmarsh. The policy of MR of the peninsula (Unit J) will enable maintenance of this habitat.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>	<p>Adverse effect</p> <p>The western side of the Spurn peninsula is lined with saltmarsh. The policy of MR of the peninsula (Unit J) will enable partial maintenance of this habitat in the long term but will not provide for the scale of sediment inputs that may be necessary to compensate for the loss of sediment from the Holderness Coast.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>

Designated international interest feature on the Spurn peninsula or at Spurn Bight	Effect from the Flamborough Head to Gibraltar Point SMP		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Mudflats and sandflats not covered by seawater at low tide (i.e. intertidal mudflats and sandflats)	<p>Adverse effect</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the intertidal mudflat on the Bight due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>	<p>Adverse effect</p> <p>As the Spurn peninsula retreats westwards it will result in a direct reduction in the physical extent of the Bight. <u>However</u>, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the intertidal mudflat on the Bight, due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>	<p>Adverse effect</p> <p>As the Spurn peninsula retreats westwards it will result in a direct reduction in the physical extent of the Bight. <u>However</u>, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the intertidal mudflat on the Bight due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4).</p>

Impacts on the Outer Estuary: South Coast of Humber Estuary from Immingham to Mablethorpe (Policy Units L to N)

- L5.50 The coastal squeeze and (in the absence of mitigation) sediment process effect as a result of a HTL policy for the Outer Humber Estuary on each habitat and species for which the SAC was designated can be described as below. A more detailed assessment against each international interest feature is presented in Table 5. The preferred policy for Policy Units L-N is HTL, though for Unit M that includes allowing the front line of defences to fail in Epoch 3..

Epoch 1 (Present – 2025)

- L5.51 During Epoch 1, there is unlikely to be an adverse effect on the habitats and species for which the Humber Estuary SAC was designated as a result of significantly reduced longshore sediment transport within Policy Units L – N, even in the absence of mitigation. There will be a localised reduction in intertidal sandflat and mudflat at the western end of Policy Unit L (between Immingham and Pywipe) as a result of erosion. Although the professional opinion of our coastal experts is that this impact is likely to be offset by accretion in the eastern part of Unit L (principally the area sheltered by the docks) Natural England advised that a more precautionary approach should be taken and an adverse effect on intertidal mudflat in Epoch 1 as a result of coastal squeeze should be assumed. It was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber from Epoch 1. The amendments made to accommodate this are discussed in Chapters 15 and 16.

Epoch 2 (2025 - 2055)

- L5.52 During Epoch 2, adverse effects will increase as erosion begins to outpace accretion within Policy Unit L and M. This will lead to a loss of intertidal habitat, although such losses will to an extent be balanced by continued accretion in Unit N. On a precautionary basis we nonetheless concluded an adverse effect on the integrity of the SAC towards the end of this Epoch as a result of coastal squeeze and it was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber in Epoch 2. The amendments made to accommodate this are discussed in Chapters 15 and 16.

- L5.53 It is not possible to identify other plans and projects for in combination consideration (since very few are planned more than 15 years in advance) other than the Humber Flood Risk Management Strategy. The Humber Flood Risk Management Strategy policy for these units does not differ from the SMP in Epoch 2, so no in combination effect will arise.

Epoch 3 (2055 – 2105)

- L5.54 Adverse effects will occur with greatest severity in Epoch 3. Coastal squeeze will continue to affect the intertidal mudflat and will spread to affect the coastal lagoons, saltmarsh and sea buckthorn-vegetated sand dune habitat that lies within Policy Units M and (particularly) N. They will also lead to an adverse effect on sandflat habitat available for the grey seal colony at Donna Nook. This constitutes an adverse effect on the integrity of the SAC and it was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber in Epoch 3. The amendments made to accommodate this are discussed in Chapters 15 and 16.

Effect of a HTL policy along sections of the Holderness Coast

- L5.55 According to the sediment processes report, the HTL policy for Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast might result in the potential for some reduction in sediment supply during Epoch 3 if the policies for the Holderness Coast did not retain sufficient flexibility to allow for additional sediment release during this Epoch. The amendments made to allow this flexibility are discussed in Chapter 14.
- L5.56 It should be noted that the conclusion that a reduction in sediment supply will become potentially significant in Epoch 3 uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, it was acknowledge that the policies or the SMP Action Plan would need to ensure that measures to further investigate and resolve this issue are in place such that any revisions to policy can be made following the obtaining of further data. This is covered further in Chapter 14.

In combination effects on Policy Units L - N

Epoch 1

- L5.57 The Humber Flood Risk Management Strategy policies for Policy Units L-N are identical to those for the SMP and there is thus no mechanism for any ‘in combination’ effect. There are a series of additional projects and plans that will be delivered within East Yorkshire and which could also contribute to an ‘in combination’ effect on the Humber Estuary SAC within Units L to N:
- The Helius Energy biomass plant at Stallingborough, the Abengoa bio-ethanol plant at Stallingborough and the Vireol bio-ethanol plant at Grimsby – these could result in adverse effects through an increase in atmospheric nitrogen emissions and therefore deposition within the estuary, which would in turn contribute to eutrophication;
 - Grimsby Proposed ‘Roll on –Roll off’ ferry berth – this project may involve direct habitat loss and disruption to sediment movements around the outer estuary due to dredging to support the berth;
 - East Yorkshire Local Development Framework and East Lindsey LDF – since both of these involve the delivery of new housing it is possible that this would be accompanied by an increased population. Since the Humber Estuary represents a significant recreational resource in the area it is also possible that this increased population could contribute cumulatively to adverse effects in the estuary by increasing habitat damage;
 - Offshore windfarms - Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula. This will operate cumulatively with those SMP policies which will lead to a reduction in sediment supply to the Humber Estuary SAC from the Holderness Coast.
- L5.58 The same amendments to policy which address the impacts of the SMP in isolation will however also address its contribution to these ‘in combination’ effects (see Chapter 14).

- L5.59 Although the Iota Dredge involves a 4.5 million m³ capital dredge and 1.5 million m³ maintenance dredge, all the sediment will remain in the estuary such that it will not result in the removal of additional sediment that would otherwise be available to supply the estuary.

Epochs 2 and 3

- L5.60 No 'in combination' assessment is possible for Epochs 2 and 3 since no projects and plans that will come on line during those Epochs are sufficiently developed at this stage.

Table 5.2: Impacts of SMP policy on the Outer Humber Estuary over the three epochs of the SMP as a result of a HTL Policy for Policy Units L-O, in the absence of mitigation. Note that the sediment process conclusions must be read within the context of paragraph 5.56 above.

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Estuaries (both overall habitat extent and function)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Any impact will be restricted to local areas, mainly at the western end of Policy Unit L during Epoch 1. Coastal squeeze and loss of intertidal habitats may occur, especially between Immingham and Pywipe due to foreshore lowering. <u>However</u> this impact is likely to be offset by accretion in other areas within Unit L (principally the area sheltered by the docks).</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion.</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The erosion impact identified during Epoch 1 within Policy Unit L will increase in severity and be accompanied by some coastal squeeze within Policy Unit M. Continued accretion will occur in Policy Unit N which will help offset intertidal losses at some locations in Unit L.</p> <p><u>Sediment transport</u></p> <p>The reduction in beach material for erosion (and thus sediment available) from the western end of Policy Unit L will be exacerbated and may be accompanied by some interruption of natural coastal processes in Policy Unit M.</p> <p>However, while the composition of the estuary will shift as intertidal sandflats and mudflats become subtidal features, the extent of the estuary will remain the same. Therefore we have concluded no adverse effect on this feature will result.</p>	<p>As for Epoch 2.</p>

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Mudflats and sandflats not covered by seawater at low tide (i.e. intertidal mudflats and sandflats)	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Any impact will be restricted to local areas, mainly at the western end of Policy Unit L during Epoch 1. Coastal squeeze and loss of intertidal habitats may occur, especially between Immingham and Pywipe due to foreshore lowering. An adverse effect has been concluded on a precautionary basis.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. This is unlikely to have a material impact on the extent of this habitat.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The erosion impact identified during Epoch 1 within Policy Unit L will increase in severity. Continued accretion will occur in Policy Unit N which will help offset intertidal losses at some locations in Unit L. Nonetheless an adverse effect has been concluded on a precautionary basis.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from the western end of Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>A shift from accretion to erosion in Policy Unit N is expected to result in a decrease in the extent of this habitat at the expense of subtidal, mudflats and sandflats. While the extent of intertidal mudflat may increase in some areas at the expense of saltmarsh and sand dune, it is not clear whether this will offset the adverse impact. A precautionary adverse effect is therefore concluded.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>
Sandbanks which are slightly covered by sea water all the time (i.e. sub-tidal sandbanks)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>In general, it is unlikely that the overall extent of this habitat will change – the extent in the western part of Unit L may increase but that in the eastern part of Unit L is likely to be subject to a counter-balancing decrease due to</p>	<p>No adverse effect</p> <p>This habitat will increase at the expense of the intertidal mudflats and sandflats as sea levels rise and the coastal defences within Policy Units L and M are maintained.</p> <p><u>Sediment transport</u></p>	<p>No adverse effect</p> <p>This habitat will continue to increase at the expense of the intertidal mudflats and sandflats and early succession saltmarsh as sea levels rise and the coastal defences within Policy Units L, M and N are maintained.</p> <p><u>Sediment transport</u></p>

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
	<p>localised accretion.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. This is unlikely to have a material impact on the extent of this habitat.</p>	<p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, the reduction in sediment deposition will probably be offset by the increase in habitat as a result of increased inundation of previously inter-tidal mud and sand flats.</p>	<p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>
Coastal lagoons	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>There are 3 saline lagoons which have been identified within the Humber Estuary SPA. Three locations within Units L - N support lagoons – Humberston Fitties, Northcoates Point and North Somercoates.</p> <p>However, none are adjacent to Policy Unit L and will therefore not be subject to coastal squeeze during Epoch 1.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The lagoons within Policy Units M and N are all further inland than those at Easington and are thus less vulnerable to sea level rise, particularly within the context of continued accretion in Policy Unit N during Epoch 2.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, none of this is likely to affect the lagoons.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>All three lagoon locations within Units L - N have flood defences located landwards and will therefore have limited room to retreat in the face of accelerating sea level rise during Epoch 3, particularly since during this epoch accretion in Unit N will shift to erosion.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
	defences prevent erosion. This is unlikely to have a material impact on the extent or quality of coastal lagoon habitat.		
Salicornia and other annuals colonising mud and sand (i.e. early succession saltmarsh)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>On the south (Lincolnshire) coast of the outer estuary, saltmarsh is found mainly from Cleethorpes to Saltfleet which is not adjacent to Policy Unit L and adverse effects will therefore not result.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. However, this will not materially alter longshore transport of sediment to other parts of the estuary.</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>On the south (Lincolnshire) coast of the outer estuary saltmarsh is found mainly from Cleethorpes to Saltfleet in proximity to Policy Unit M and N. As such, the coastal squeeze predicted to commence in Policy M during Epoch 2 will result in a local reduction in the extent of saltmarsh. However, since the area of saltmarsh in Unit M is so small, this would be offset by saltmarsh expansion associated with continuing accretion in Unit N.</p> <p>The extent of early succession saltmarsh can be expected to increase in the short-intermediate term as sea levels rise and the period of inundation increases, putting back the saltmarsh succession.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>A shift from accretion to erosion in Policy Unit N is expected to result in a decrease in the extent of this habitat at the expense of intertidal, and ultimately subtidal, mudflats and sandflats.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Atlantic salt meadows (i.e. mid-succession saltmarsh)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>On the south (Lincolnshire) coast of the outer estuary, saltmarsh is found mainly from Cleethorpes to Saltfleet which is not adjacent to Policy Unit L and adverse effects will therefore not result.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. However, this will not materially alter longshore transport of sediment to other parts of the estuary.</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>On the south (Lincolnshire) coast of the outer estuary saltmarsh is found mainly from Cleethorpes to Saltfleet in proximity to Policy Unit M and N. As such, the coastal squeeze predicted to commence in Policy M during Epoch 2 will result in a local reduction in the small extent of saltmarsh in Unit M.</p> <p>However, this would be offset by saltmarsh expansion associated with continuing accretion in Unit N; therefore we have concluded there will be no overall loss of this habitat.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p> <p>However, this would be offset by saltmarsh expansion associated with</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>A shift from accretion to erosion in Policy Unit N is expected to result in a decrease in the extent of this habitat at the expense of early succession saltmarsh and ultimately intertidal mud and sandflats.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Dunes with sea buckthorn <i>Hippophae rhamnoides</i>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Small areas of sand dune are present on the South (Lincolnshire) part of the estuary, from Donna Nook to Mablethorpe within Policy Unit N. This is not adjacent to Policy Unit L and adverse effects will therefore not result.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. However, this will not materially alter longshore transport of sediment to other parts of the estuary.</p>	<p>continuing accretion in Unit N; therefore overall we have concluded there will be no overall loss of this habitat.</p> <p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Small areas are present on the South (Lincolnshire) part of the estuary, from Donna Nook to Mablethorpe within Policy Unit N. Unit N is expected to continue accreting during Epoch 2 such that there should be no adverse effect.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, this would be offset by dune expansion associated with continuing accretion in Unit N.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>A shift from accretion to erosion in Policy Unit N is expected to result in a decrease in the extent of this habitat at the expense of intertidal sandflats.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>
Sea lamprey <i>Petromyzon marinus</i>	<p>No adverse effect</p> <p>The outer estuary is primarily of importance as a migration route for this species, which spawns further upstream in the River Derwent (a tributary of the Ouse). As such the</p>	As for Epoch 1	As for Epoch 1

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
	SMP will not have an adverse effect on this species as neither the water column nor habitats in the middle/upper estuary will be affected so that migration will continue unimpeded.		
River lamprey <i>Lampetra fluviatilis</i>	No adverse effect The outer estuary is primarily of importance as a migration route for this species, which spawns further upstream in the River Derwent (a tributary of the Ouse). As such the SMP will not have an adverse effect on this species as neither the water column nor habitats in the middle/upper estuary will be affected so that migration will continue unimpeded.	As for Epoch 1	As for Epoch 1
Grey seal <i>Halichoerus grypus</i>	No adverse effect <u>Coastal squeeze</u> The grey seal colony (up to 3,000 animals) is located from October – December on the beach at Donna Nook and will thus be unaffected by coastal squeeze within the vicinity of Policy Unit L. <u>Sediment transport</u> During Epoch 1 most sediment transport around the estuary would	No adverse effect <u>Coastal squeeze</u> The grey seal colony (up to 3,000 animals) is located from October – December on the beach (intertidal sandflats) at Donna Nook within Policy Unit N and they breed up to the edge of the dunes. However, this Unit is expected to continue accreting until Epoch 3 such that no adverse effect will result. <u>Sediment transport</u>	Adverse effect <u>Coastal squeeze</u> The intertidal sandflat habitat in Policy Unit N will start to erode during this epoch as sea level rises and coastal defences are maintained. <u>Sediment transport</u> The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
	<p>continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. However, this will not materially alter longshore transport of sediment to other parts of the estuary.</p>	<p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, this would be offset by habitat expansion associated with continuing accretion in Unit N.</p>	<p>the outer estuary.</p>

Summary of adverse effects on the Humber Estuary SAC

L5.61 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies and that amendments to policy would be needed to either mitigate the effects or (mainly with regard to coastal squeeze) to facilitate compensatory habitat provision:

Epoch 1

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- An adverse effect on the internationally important habitats of The Lagoons SSSI (Easington Lagoons) as a result of a HTL policy in Policy Unit I resulting in coastal squeeze;
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy; and
- A possible adverse effect on the intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy.

Epoch 2

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy; and
- An adverse effect on the intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy.

Epoch 3

- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy;
- Continuing adverse effects on the intertidal mudflats within Policy Units L and M. Adverse effects may (as a worst case scenario) also occur on the coastal lagoons, sand dune and saltmarsh in Policy Unit N due to a shift from accretion to erosion;
- An adverse effect on sandflat habitat available for the grey seal colony at Donna Nook within Policy Unit N as a result of coastal squeeze due to a HTL policy; and
- An adverse effect throughout the Humber Estuary SAC as a result of increased erosion associated with a reduction in sediment deposition as a result of the coastal defences with Policy Unit L and Policy Unit M and Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast. It should be noted that this uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, the SMP Action Plan must include measures to further investigate and resolve this issue such that any revisions to policy can be made following the obtaining of further data.

L5.62 The coastal squeeze effects in Epochs 1 and 2 will act 'in combination' on the estuary as a whole with the HTL policies for the Inner and Middle Estuaries as set out in the Humber Flood Risk Management Strategy, which will also lead to coastal squeeze.

L6 Appropriate Assessment: Humber Estuary SPA

- L6.1 This Chapter documents the Appropriate Assessment of the Flamborough Head to Gibraltar Point SMP with regard to those Policy Units for which the preferred policy could not be screened out as ‘unlikely to lead to significant effects’ on the Humber Estuary SPA. Easington Lagoons and Spurn Point are dealt with separately from the remainder of the estuary as in the preceding chapter.
- L6.2 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter 14 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur. Chapters 15 and 16 then address amendments that have been made to the final SMP policy in order to facilitate compensatory habitat creation triggered by those residual adverse effects. It should be noted that the ‘no alternatives’ and IROPI arguments that need to be made as part of the ‘IROPI case’ to the Secretary of State associated with the provision of compensatory habitat will be set out in a separate document.

Humber Estuary SPA as a whole (including inner and middle estuaries)

- L6.3 Before undertaking a detailed evaluation of the impacts and effects of the SMP on the components of the outer Humber Estuary, it is useful to consider impacts on the integrity of the SPA as a functional unit. This is particularly important given that many of the birds for which the SPA was designated are likely to travel between different breeding, roosting and foraging locations around the estuary during the course of a year rather than confining themselves to a single location.
- L6.4 The bird interest of the SPA is susceptible to much the same impacts as will affect the SAC, in that the adverse effects on the SAC habitats due to coastal squeeze (from both the SMP and Humber Flood Risk Management Strategy) and reduction in sediment inputs due to an HTL policy along parts of the Holderness Coast (if flexibility for additional sediment release was not incorporated into SMP policy) would also result in loss of habitat for the bird interest of the SPA. However, there are additional impacts that apply specifically to the SPA interest features:
- several habitats present within the estuary that are not of international importance in themselves are of considerable importance as habitat for the SPA birds – this particularly applies to the reedbeds which are concentrated in the inner and middle estuaries and would be adversely affected both by reduced sediment from the Holderness Coast during Epoch 3 (in the absence of mitigation) and direct losses from Epoch 1 due to the flood defences being introduced under the Humber Flood Risk Management Strategy;
 - the bird interest of the SPA is susceptible to noise and visual disturbance in a way that most of the features of the SAC are not. Such disturbance would be particularly associated with the SMP during the construction of defences if construction occurs during unsuitable periods.

Disturbance

- L6.5 Disturbance during construction of defences in the outer estuary could lead to displacement of birds into either the inner/middle estuaries (if their required habitat was available) or away from the Humber estuary entirely. Such displacement would result in increased competition for resources on a) the remaining habitat within the outer estuary and b) the habitats into which the wildfowl are displaced. If insufficient resources were available this increased competition would lead to reduced health and condition and potentially increased mortality and reduced breeding success. Moreover, the process of displacement will mean greater energetic expenditure to reach alternative roosts and feeding sites which in itself can result in reduced health/condition and survival.
- L6.6 The disturbance impacts would potentially be exacerbated across the Humber Estuary as a whole through the implementation of the Humber Flood Risk Management Strategy, since this may also result in displacement of birds from the entire length of the Humber Estuary SPA if not appropriately timed. As such, it was not possible to conclude that the works required under the SMP policies would not result in adverse effects without the incorporation of the mitigating measures discussed in Chapter L13.

Direct habitat loss due to coastal squeeze and defence footprint

- L6.7 The Appropriate Assessment of the Humber Flood Risk Management Strategy (by Halcrow on behalf of the Environment Agency, 2009) calculates that a total of approximately 790ha of habitat within the estuary as a whole will be lost to coastal squeeze over the 50-year Strategy period (plus a further 40ha of direct losses due to the defences themselves). Approximately 230 ha of losses due to coastal squeeze (and 10ha of direct losses due to the defences themselves) will be located within the outer estuary and can therefore be considered to be a result not only of the Humber Flood Risk Management Strategy but also the SMP policy for Units I to N during SMP Epochs 1 and 2.
- L6.8 The Humber Flood Risk Management Strategy does not cover SMP Epoch 3; however, it is likely that the losses in Epoch 3 are likely to be at least as great as those that will occur during the two preceding Epochs. Due to the increased rate of sea level rise during Epoch 3, losses during Epoch 3 are in fact likely to be greater.
- L6.9 This would clearly constitute an adverse effect on the integrity of the SPA due to the loss of habitat for the internationally important bird populations and it was identified that if this could not be avoided SMP policy would need to make provision for the delivery of compensatory habitat through local MR. This is covered further in Chapters L14 and L15.

Loss of sediment locked behind the defences of the Holderness Coast

- L6.10 As with the SAC, adopting a policy of HTL for Policy Units B (Bridlington), D (Hornsea), E (partially, with regard to Mappleton), F (Withernsea) and H (Dimlington & Easington Gas Terminals) without the amendments that have been made to facilitate potential sediment release in response to sea level rise (these amendments are discussed in Chapter 14) would continue to ensure that up to 3.4% of the current overall potential volume of sediment could fail to reach the SPA. While this is a small proportion, it would represent a large volume and its continued absence would be likely to become increasingly important as erosion rates within the

estuary increased over the SMP timescale (during Epoch 3), particularly when this is considered cumulatively with habitat losses throughout the estuary due to coastal squeeze and interruptions in long-shore sediment transport due to the development of promontories (see below).

Interruption to long-shore sediment transport due to emerging promontories

- L6.11 As with the SAC, if sections of the Holderness Coast are prevented from eroding due to an HTL policy, this will mean that over time a system of bays (in those sections where erosion has been allowed) and promontories (in those sections where it has been prevented) will develop. The promontories will themselves act as sediment traps thus further disrupting the supply of sediment to the Humber Estuary SPA, even from sections of coast that are allowed to erode.
- L6.12 The sediment process report indicates that this may happen during Epoch 3 without the amendments that have been made to facilitate potential sediment release in response to sea level rise (these amendments are discussed in Chapter L13).. There are no predictions available concerning the actual quantities of sediment that may be trapped but it clearly could not be concluded that the trapping of sediment by these emerging promontories would not have an adverse effect on the SPA and amendments to policy were therefore required to allow for additional sediment release (see Chapter L13)..

In combination effects other than the Humber Flood Risk Management Strategy on the Humber Estuary SPA as a whole

- L6.13 The impacts of the SMP have already been considered 'in combination' with the Humber Flood Risk Management Strategy. There are however a series of additional projects and plans that will be delivered within the East Yorkshire and north east Lincolnshire areas and which could also contribute to an 'in combination' effect on the Humber Estuary SPA as a whole either by exacerbating an adverse effect of the SMP (particularly contributing additional disturbance sources that could operate in combination with the coastal defence maintenance work if undertaken at inappropriate times of year) or by introducing new adverse effects that could occur at the same time as the implementation of the SMP and thus work cumulatively on the SPA:
- Helius Energy biomass plant at Stallingborough, the Abengoa bioethanol plant at Stallingborough and the Vireol bioethanol plant at Grimsby – these could lead to increased atmospheric nitrogen emissions (and therefore deposition within the estuary) contributing to eutrophication. Such eutrophication could result in adverse effects on SPA birds if it resulted in the development of macroalgae that would smother feeding habitats;
 - New 20,000 seat Grimsby town football stadium at Great Coats – although a major project on the south bank of the estuary, no mechanism for any adverse effect has been identified.
 - Grimsby Proposed 'Roll on –Roll off' ferry berth – this project may involve habitat loss due to dredging to support the berth;
 - East Yorkshire Local Development Framework and East Lindsey LDF – since both of these involve the delivery of new housing it is possible that this would be accompanied by an increased population. Since the Humber Estuary represents a significant recreational resource in the area it is possible that new visitors will contribute cumulatively to adverse effects in the SPA by increasing exposure of waterfowl to visual disturbance;

- Windfarms: potential to be proposed in various locations. Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula;
 - Iota Dredge – This project involves a 4.5 million m³ capital dredge and 1.5 million m³ maintenance dredge. However, all the sediment will remain in the estuary such that it will not result in the removal of additional sediment that would otherwise be available to supply the estuary
- L6.14 The same amendments to policy which address the impacts of the SMP in isolation will however also address its contribution to these 'in combination' effects (see Chapter L13).

The sections of the Outer Estuary

Easington Lagoons (The Lagoons SSSI)

- L6.15 Easington Lagoons (The Lagoons SSSI) comprise saltmarsh, shingle, sand dune, swamp and most significantly, saline lagoons and pools which represent the only extant example in East Yorkshire of this habitat. The northern lagoon is bounded by flood banks that to the east have been historically breached and overtopped to form the current lagoon. To the south there is a further saline waterbody formed by tidal inundation of a former borrow pit. Of particular importance is the colony of over 1% of the British breeding population of little tern, a rare species which nests on the sand dune and shingle storm beach seaward of the northern lagoon. The lagoons are also of importance for wintering and passage bird species.

Spurn Point and Spurn Bight (Policy Units J and K)

- L6.16 The peninsula of Spurn Head extends from Kilnsea Warren, at the southern end of the Holderness cliffs, and forms a barrier extending 5 km into the mouth of the Humber Estuary. Welwick Marsh and adjacent upper shore habitats in the vicinity of Spurn Bight are important for providing extensive areas of intertidal mudflat and saltmarsh which in turn supports numerous breeding and roosting birds. Welwick marsh supports breeding territories of waterfowl including shelduck, mallard, redshank and snipe as well as wintering Marsh harrier. Flocks of over 200 brent geese are regularly recorded on this section, along with in excess of 1,000 shelduck. Oystercatcher flocks are regularly observed in excess of 1,000 during the winter, together with peaks of over 10,000 knot and dunlin (Cutts 1998²⁶). Smaller flocks of golden plover and grey plover occur with flocks in excess of 1,000, with redshank and curlew also present in high numbers. Ringed plover breed on the shingle/sand along the upper shore of Spurn Bight (Gillon 1995²⁷; Bell & Degnan 2001²⁸).

²⁶ Cutts, N.D. 1998. Humber Estuary environmental baseline: Ornithological summary. Hull: Institute of Estuarine & Coastal Studies, University of Hull. Report to Binnie, Black & Veatch

²⁷ Gillon, K. 1995. Little terns at Easington Lagoons. A report on the 1995 breeding season. Spurn Heritage Coast Project

²⁸ Bell, N.A. & Degnan, L.J., eds., 2001. Spurn wildlife No.10. Spurn Bird Observatory

South Coast of Humber Estuary from Immingham to Mablethorpe (Policy Units L- N)

- L6.17 Allen *et al* (2003)²⁹ provide an overview of historical trends in waterbird populations for the wider Humber SPA between 1979/80 and 1999/2000, based on annual WeBS count data. Their estimates indicated that the Humber waterfowl population increased substantially during that period, with general increases in the wader assemblage and broadly stable populations of wildfowl.
- L6.18 The key habitats of importance in the outer estuary for the Annex I species for which the SPA was designated are intertidal mudflats and sandflats, saltmarsh communities, tidal reedbeds, coastal lagoons and unvegetated sand and shingle. The Humber Estuary SPA is designated for four named breeding species – bittern, marsh harrier, avocet and little tern. Of these, the bittern and breeding marsh harrier are confined to the reedbeds of the middle and inner estuary and avocet is present primarily on Read's Island and Blacktoft Sands.
- L6.19 On the south bank of the estuary, the main area of ornithological interest is the intertidal mudflats of Pyewipe, supporting regionally important numbers of passage and wintering waterfowl. High water roosts have been established on the fields east of Stallingborough power station for golden plover and lapwing, with curlew using the flat roofs of industrial units in the area (Shepherd *et al* 1982)³⁰. In addition, more recent data has indicated that there are many fields on the south Humber banks which are important for roosting and feeding of SPA birds at high tide.
- L6.20 The Cleethorpes shore is characterised by dry sand ridges, muddy basins and backed in part by low dunes and as such are distinct from the more muddy intertidal mudflats within the main body of the estuary. Despite the very high level of human disturbance, it can support large numbers of waterfowl, with knot in particular occurring in internationally important flocks with numbers in excess of 10,000 regularly observed in the latter part of the winter, with movement of flocks between this area and Spurn Bight. Other wader species use the area in important numbers (Eco Surveys 1990³¹).
- L6.21 The Tetney section of the coast centres on the outfall of the Louth Canal and includes soft mudflats, sand flats and sandy ridges, backed by saltmarsh and dune. Feeding is carried out across the majority of habitats, depending on prey preference, with high tide roosts established on the sand ridges, and saltmarsh. A breeding colony of little tern was present within the area and although they have not bred successfully since 1990's they do still attempt to breed³². Oystercatcher, ringed plover and redshank also breed on the saltmarsh and adjacent high sand and shingle habitats (Eco Surveys 1990).
- L6.22 The Grainthorpe, Donna Nook and Saltfleet reach comprises an extensive intertidal area dominated by fine sand and areas of mud and shingle, backed by saltmarsh, dune and buckthorn. This section of coast supports nationally important numbers of brent geese, shelduck and redshank, together with locally important numbers of other waterfowl and roosting marsh harrier in the winter.

²⁹ Allen, J. Boyes, S. Burdon, D. Cutts, N. Hawthorne, E. Hemingway, K. Jarvis, S. Jennings, K. Mander, L. Murby, P. Proctor, N. Thomson S. & Waters, R. 2003. Humber Comprehensive Review. English Nature

³⁰ Shepherd, I.G., Hayhow, S.J. & Roden, A. 1982. Birds of Pyewipe mudflats. Hull: Department of Zoology, University of Hull

³¹ Eco Surveys Ltd. 1990. Winter wildfowl and wader feeding area study along the Lincolnshire and South Humberside coast 1989-1990. Report to the NRA

³² Nick Tribe, Natural England, personal communication, September 2009

Impacts on the Outer Estuary: Easington Lagoons (Policy Unit I)

- L6.23 Easington Lagoons originated partly as man-made borrow pits and the rest from flooded farmland. The material from the borrow pits was used to create the flood defences to the rear of the lagoons. They are situated on the Holderness coast some 2 kilometres north of Spurn peninsula and south-east of Easington village.

Coastal squeeze

- L6.24 The site is already noted to be suffering from coastal squeeze. The most recent Natural England condition assessment indicates that *'The site was visited in April and May 2003; the condition of the lagoons (with respect to water levels) was reasonable. However, changes in beach levels and loss of sand dune habitat were noticeable. There was a need to check beach monitoring work ... and ensure that future consideration is given to address coastal squeeze as a result of the flood defences. The flood defence is reducing the ability of the site to adapt to these changes (coastal erosion) causing the extent of the Lagoons and the numbers of associated birds and features to decline.'* Since these issues are so well known they have already been subject to consideration as part of the Humber Estuary Flood Risk Management Strategy. Specifically, a 2007 report 'The Implications of Coastal Change on Natura 2000 Features of The Lagoons at Easington' investigated the issues relating to this site and made recommendations for avoiding or mitigating adverse effects.
- L6.25 The 2007 report confirmed that the Northern Lagoon area will deteriorate as a high tide roost due to encroachment of sand dunes on to areas of sand and shingle and reduction of sightlines to critical disturbance thresholds and that the Southern Lagoon area will deteriorate as a high tide roost on extreme high tides. A follow-up report ('The Lagoons: N2K Long Term Plan & Options Development Report') has recently been produced by the Environment Agency which discusses these impacts in more detail (see Table 6.1 below).
- L6.26 Table 6.1 indicates that there will be loss of the habitat attributes that support the internationally important interest features of The Lagoons within 30 years. The report 'The Lagoons: N2K Long Term Plan & Options Development' concluded that in the long term (30 -100 year period) many of the interest features will be supported by extensive areas of tidally inundated land following the breach and breakdown of the existing coastal and estuarine defences.
- L6.27 Neither Environment Agency report appears to consider impacts of a decline in sediment supply from the Holderness Coast but the sediment process report for the SMP identifies that sediment supply is not likely to decline significantly until long after the Easington Lagoons will have been lost. However, sediment supply is an important consideration in terms of delivering the compensatory habitat for the lagoons.
- L6.28 It was therefore concluded that the HTL preferred policy option for Policy Unit I during Epoch 1 would lead to an adverse effect on the internationally important SPA interest features of The Lagoons SSSI (its populations of breeding little tern and wintering/passage waterfowl) without amendments being made to either avoid the effect or facilitate MR and compensatory habitat provision in a suitable location in the outer estuary (see Chapter 14 for details).

Table 6.1: Predicted evolution of The Lagoons SSSI or N2K feature supporting habitats over the next 100 years (after Environment Agency, 2009³³)

Year	Coastal / Tidal Area	Projected Event/Process	Predicted Effect
2008	SPA: 24.5ha	Southern Lagoon: Increased overtopping frequency will maintain a flattened profile of the barrier beach but will lead to increase tidal incursion of roosting areas.	Continued viability of little tern breeding population through maintenance of bare sand and shingle areas and other landscape features for nesting. Likely reduction in the viability of the Southern Lagoon site as a high tide roost on extreme tides. The population most sensitive to such events is likely to be knot. Populations of grey plover, dunlin and redshank may also be affected, in the absence of suitable roosting sites on adjacent land.
		Northern Lagoon: Filling in of shallow water area with sand and shingle and encroachment of dune onto existing roosting habitat.	Likely net loss of existing sand and shingle areas to dune encroachment. Reduction in sightlines. Populations most likely to be affected will be knot, redshank, dunlin and brent goose.
2018	SPA: 18.8ha	Southern Lagoon: Increasing frequency of overtopping and uncertainty over habitat development and distribution of sand & shingle, shallow water and salt marsh within the site.	Viability of little tern nesting activity and fledgling success becomes uncertain within this timeframe. Change in habitat mosaic and likely increase in diversity may lead to loss and/or gain of attributes that support Interest Features. E.g., an increasing intertidal exchange may increase the abundance of intertidal prey species for waders. Reduction in overall area and increased frequency in overtopping increases the risk of disturbance to all Interest Features and reduces viability of site as a high tide roost on extreme tides. Populations of birds most likely to be affected will be knot, redshank, dunlin & grey plover.
2028	SPA: 15.5ha	Northern and Southern Lagoon Areas: Extensive erosion of coastal habitats.	Continued loss of remaining habitat attributes that support the roosting and breeding interest associated with The Lagoons.
2038	SPA: 12.3ha	The Lagoons: Extensive erosion of coastal habitats.	Effective loss of remaining support provided by The Lagoons Site to SPA Interest Features.

In combination effects on Easington Lagoons

Epoch 1

L6.29 The Humber Flood Risk Management Strategy covers Easington Lagoons and there is thus no mechanism for any 'in combination' effect. Until such time as the existing habitat is lost however there will be a potential disturbance impact associated with maintenance of the defences within this Unit during Epoch 1 if undertaken at inappropriate times of year. There is

³³ Environment Agency, 2009. The Lagoons: N2K Long Term Plan & Options Development Report

one additional projects or plan that will be delivered in East Yorkshire which could contribute to an 'in combination' disturbance effect on waterfowl using The Lagoons:

- East Yorkshire Local Development Framework – since this involves the delivery of additional housing in the district it is possible that this would be accompanied by an increased population. It is possible that new visitors will contribute cumulatively to adverse effects on The Lagoons by increasing exposure of waterfowl to visual disturbance.

L6.30 However, the contribution of the SMP to any adverse effect can be removed through appropriate mitigation for its own impacts. These are considered further in Chapter L13.

Epochs 2 and 3

L6.31 Since, according to the Environment Agency reports, all habitat of relevance to internationally important species would have ceased to exist at Easington Lagoons during Epoch 1 if no mitigation/compensation is made, no 'in combination' effects would arise during Epochs 2 and 3.

Impacts on the Outer Estuary: Spurn Point (Policy Unit J)

L6.32 The Spurn Peninsula comprises two distinct sections; a series of connected "islands" formed by the accumulation of coarse sediment behind and protected by the moraine ridges and a barrier connecting this feature to the Holderness cliff-line. An important difference between these two sections is that the barrier is free to erode and retreat, whereas the "island" is protected.

L6.33 The preferred policy for Policy Unit J (Kilnsea to Spurn Point) is MR with the possibility of NAI in Epochs 2 and 3. The process of realignment of the Spurn peninsula may result during Epochs 2 and 3 in some reduction in the extent of intertidal mudflat at Spurn Bight, which lies behind the peninsula. These mudflats and sandflats are internationally important habitats in themselves and are one of the major wintering bird roost locations of the outer estuary. However, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J, provided that repair of breaches to the Peninsula does not involve encroachment onto the mudflats of the Bight, as such encroachment would exacerbate coastal squeeze.

Sediment movement

L6.34 Spurn provides shelter for the extensive mudflats of Spurn Bight within the estuary that have accreted on its landward side and are internationally important for wintering/passage waterfowl. It also affords a limited degree of shelter from waves from the north-east to the frontages of Cleethorpes and Grimsby on the south bank of the estuary.

L6.35 The MR policy for Policy Unit J is intended to partially address the issue of avoiding breaches to the peninsula, with intervention (generally through softer engineering solutions, such as sediment nourishment) to minimise the risk of breaches and maintain the integrity of the barrier. However, the MR policy as it is written will only provide small scale minimal intervention repair rather than large scale sediment nourishment schemes. It would therefore not cancel out the adverse effect of the preferred policies for Units B, D, E (with regard to Mappleton), F and H on the Spurn peninsula during Epoch 3. Further wording was therefore identified as being

necessary for incorporation into policy to cover the issue of a reduction in sediment supply from the Holderness Coast. These amendments are discussed in Chapter L13.

- L6.36 Shoreface erosion and longshore transport provides coarse sediment to the Humber mouth sediment sinks/stores (the Binks, New Sand Hole and mobile sand sheets). However, the MR preferred policy for Policy Unit J should not interfere with natural sediment transport from the peninsula.

Impacts on the Outer Estuary: Spurn Bight (Policy Unit K)

- L6.37 The defence of Spurn Bight itself (and the remainder of the north bank of the outer estuary) will be decided by the preferred policy for Policy Unit K. The SMP policy for all Epochs is HTL. It was recognised that this would have an adverse coastal squeeze effect during all 3 Epochs on the intertidal mudflat and saltmarsh of Spurn Bight and Welwick Marsh and that the reduction in habitat extent would be likely to have resulting displacement effects on the populations of wintering waterfowl that use Welwick saltmarsh and Spurn Bight. This will in turn increase pressure on habitat elsewhere in the outer estuary, middle and inner parts of the estuary or displacement to alternative sites altogether (as discussed earlier). If this could not be avoided amendments would therefore need to be made to policy to allow for local MR within Unit K which would facilitate compensatory habitat provision. This is covered in more detail in Chapters L14 and L15.
- L6.38 The SMP policy for Unit K involves the maintenance of defences (as opposed to the Humber Flood Risk Management Strategy which states that maintenance will be withdrawn). It is possible therefore that the SMP will result in a small additional increase in habitat loss if the defence footprint is increased and policy wording was devised for the SMP or Action Plan to address this point (see Chapter 14). However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint).
- L6.39 The potential for an adverse effect also needs to be considered within the context of the disturbance effects that are likely to result from the allocations made for development through the East Yorkshire Local Development Framework (LDF), Easington to Paull gas pipeline and offshore windfarm projects planned for the Humber Estuary and the coastal squeeze effects that the Appropriate Assessment for the Humber Flood Risk Management Strategy (2009) has identified as occurring within the inner and middle parts of the estuary over the same time period. These would lead to an adverse effect 'in combination' with the Flamborough Head to Gibraltar Point SMP during Epoch 1 without mitigation being built into SMP policy.
- L6.40 The impacts of SMP policy on the SPA interest of Spurn peninsula and Spurn Bight over the three epochs of the SMP as a result of an MR policy for Policy Unit J and an HTL policy for Unit K are set out in Table 6.2, below.

Table 6.2: Impacts of SMP policy on Spurn peninsula and Spurn Bight over the three epochs of the SMP as a result of a MR policy for Policy Unit J and HTL for Policy Unit K in the absence of mitigation.

Designated international interest feature on the Spurn peninsula or at Spurn Bight	Effect from the Flamborough Head to Gibraltar Point SMP		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Wintering waders and wildfowl, and passage waders			
153,934 waterfowl representing a range of species	<p>Adverse effect</p> <p>A large proportion of the wintering waterfowl assemblage for which the SPA is designated use the intertidal mudflats at Spurn Bight and the saltmarsh that lies landwards of the mudflats.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh and therefore a reduction in available habitat for these species, due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4). There will also be an increase in pressure on habitat within the inner and middle estuaries as birds are displaced.</p>	<p>Adverse effect</p> <p>As the Spurn peninsula retreats westwards it will result in a direct reduction in the physical extent of the Bight. However, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh and therefore a reduction in available habitat for these species, due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4). There will also be an increase in pressure on habitat within the inner and middle estuaries as birds are displaced.</p>	<p>Adverse effect</p> <p>As the Spurn peninsula retreats westwards it will result in a direct reduction in the physical extent of the Bight. However, any reduction would be the result of a natural process that would occur even if the SMP set no policy whatsoever. It is therefore not considered to be an adverse effect of the preferred policy for Unit J.</p> <p>The HTL policy for Unit K will result in a direct reduction in the physical extent of the saltmarsh on Spurn Bight and Welwick Marsh and therefore a reduction in available habitat for these species, due to coastal squeeze (and possibly due to any increase in defence footprint to meet P4). There will also be an increase in pressure on habitat within the inner and middle estuaries as birds are displaced.</p>

In combination effects on Policy Units J and K

Epoch 1

- L6.41 There are a series of additional projects and plans that will be delivered within East Yorkshire and which could also contribute to an 'in combination' effect on the Humber Estuary SPA within Units J and K. This will occur primarily by contributing additional disturbance sources that could operate in combination with the coastal defence maintenance work if undertaken at inappropriate times of year:
- Humber Flood Risk Management Strategy – the SMP policy for Unit K involves the maintenance of defences (as opposed to the Humber Flood Risk Management Strategy which states that maintenance will be withdrawn). It is possible therefore that the SMP will result in a small additional increase in habitat loss if the defence footprint is increased. However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint);
 - East Yorkshire Local Development Framework - particularly recreational pressure and disturbance of waterfowl associated with the increased population occupying the 17,850 dwellings to be developed under the Core Strategy from 2011 – 2026; and
 - Windfarms: potential to be proposed in various locations. Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula.
- L6.42 However, the contribution of the SMP to any adverse effect can be removed through appropriate mitigation for its own impacts. These are considered further in Chapter L13.

Epochs 2 and 3

- L6.43 Little 'in combination' assessment is possible for Epochs 2 and 3 since no projects and plans that will come on line during those Epochs are sufficiently developed at this stage. The only other plan or project identified is the Humber Flood Risk Management Strategy where continuation of the impacts identified Epoch 1 is likely.

Impacts on the Outer Estuary: South Coast of Humber Estuary from Immingham to Mablethorpe (Policy Units L to N)

- L6.44 The coastal squeeze and (in the absence of mitigation) sediment process effect as a result of a HTL policy for the Outer Humber Estuary on the species for which the SPA was designated can be described as below. A more detailed assessment against each international interest feature is presented in Table 6.3. The preferred policy for Policy Units L-N is HTL, though for Unit M that includes allowing the front line of defences to fail in Epoch 3..

Epoch 1 (Present – 2025)

- L6.45 During Epoch 1, there is unlikely to be an adverse effect on the species for which the Humber Estuary SPA was designated as a result of significantly reduced longshore sediment transport within Policy Units L – N, even in the absence of mitigation. There will be a localised reduction

in intertidal sandflat and mudflat at the western end of Policy Unit L (between Immingham and Pywipe) as a result of erosion. Although the professional opinion of our coastal experts is that this impact is likely to be offset by accretion in the eastern part of Unit L (principally the area sheltered by the docks) Natural England advised that a more precautionary approach should be taken and an adverse effect on intertidal mudflat in Epoch 1 as a result of coastal squeeze should be assumed. Since the Cleethorpes/Pyewipe area is one of the main population centres for passage and wintering waterfowl, it was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber from Epoch 1. The amendments made to accommodate this are discussed in Chapters L14 and L15.

Epoch 2 (2025 - 2055)

- L6.46 During Epoch 2, adverse effects will begin to occur as erosion begins to outpace accretion within Policy Unit L and M. This will lead to a loss of intertidal habitat and indirectly to an increase in pressure on key bird foraging and roosting areas within the inner and middle estuary due to the presence of wildfowl displaced from the outer estuary, although habitat loss will be offset to an extent by continued accretion in Unit N. Nonetheless, as a precaution we concluded an adverse effect on the integrity of the SPA towards the end of this Epoch as a result of coastal squeeze and it was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber in Epoch 2. The amendments made to accommodate this are discussed in Chapters L14 and L15.

Epoch 3 (2055 – 2105)

- L6.47 Adverse effects will occur with greatest severity in Epoch 3. Coastal squeeze will continue to affect the intertidal mudflat and will spread to affect the coastal lagoons, saltmarsh and sea buckthorn-vegetated sand dune habitat that lies within Policy Units M and (particularly) N. They will also lead to an adverse effect on the populations of redshank, breeding tern, golden plover, black-tailed godwit and bar-tailed godwit that concentrate on Tetney Marshes within Policy Unit N. Adverse effects adjacent to Policy Unit L that commenced during Epoch 1 will increase in severity. This constitutes an adverse effect on the integrity of the SPA and it was therefore identified that if this could not be avoided provision would need to be made in SMP policy for local MR on the south bank of the Humber in Epoch 3. The amendments made to accommodate this are discussed in Chapters L14 and L15

Effect of a HTL policy along sections of the Holderness Coast

- L6.48 According to the sediment processes report, the HTL policy for Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast might result in the potential for some reduction in sediment supply during Epoch 3 if the policies for the Holderness Coast did not retain sufficient flexibility to allow for additional sediment release during this Epoch. The amendments made to allow this flexibility are discussed in Chapter 14.
- L6.49 It should be noted that the conclusion that a reduction in sediment supply will become potentially significant in Epoch 3 uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, it was acknowledge that the policies or the SMP Action Plan would need to ensure that measures to further investigate and resolve this issue are in place such that any revisions to policy can be made following the obtaining of further data. This is covered further in Chapter 14.

In combination effects on Policy Units L - N

Epoch 1

- L6.50 The Humber Flood Risk Management Strategy policies for Policy Units L-N are identical to those for the SMP and there is thus no mechanism for any 'in combination' effect. There are a series of additional projects and plans that will be delivered within East Yorkshire and which could also contribute to an 'in combination' effect on the Humber Estuary SPA within Units L to N. This will mainly occur through contributing additional disturbance sources that could operate in combination with the coastal defence maintenance work if undertaken at inappropriate times of year:
- The Helius Energy biomass plant at Stallingborough, the Abengoa bio-ethanol plant at Stallingborough and the Vireol bio-ethanol plant at Grimsby – these could result in adverse effects through an increase in atmospheric nitrogen emissions and therefore deposition within the estuary, which would in turn contribute to eutrophication;
 - Grimsby Proposed 'Roll on –Roll off' ferry berth – this project may involve direct habitat loss and disruption to sediment movements around the outer estuary due to dredging to support the berth;
 - East Yorkshire Local Development Framework and East Lindsey LDF – since both of these involve the delivery of new housing it is possible that this would be accompanied by an increased population. Since the Humber Estuary represents a significant recreational resource in the area it is also possible that this increased population could contribute cumulatively to adverse effects in the estuary by increasing habitat damage; and
 - Offshore windfarms - Natural England has specifically identified two off-shore windfarms of relevance – the Humber Gateway (E.On) project and a windfarm at Westernmost Rough. The latter is still in the early stages of planning but the former is of importance since the project Appropriate Assessment has concluded that the supply cable will result in a 1% reduction in sediment transport along the Spurn Peninsula. This will operate cumulatively with those SMP policies which will lead to a reduction in sediment supply to the Humber Estuary SAC from the Holderness Coast.
- L6.51 The same amendments to policy which address the impacts of the SMP in isolation will however also address its contribution to these 'in combination' effects (see Chapter L13).
- L6.52 Although the Iota Dredge involves a 4.5 million m³ capital dredge and 1.5 million m³ maintenance dredge, all the sediment will remain in the estuary such that it will not result in the removal of additional sediment that would otherwise be available to supply the estuary.

Epochs 2 and 3

- L6.53 No 'in combination' assessment is possible for Epochs 2 and 3 since no projects and plans that will come on line during those Epochs are sufficiently developed at this stage. Although defence maintenance works associated with the Humber Flood Risk Management Strategy could cause disturbance if undertaken at inappropriate times of year, its policies for Units L-N are identical to those for the SMP and there is thus no mechanism for any 'in combination' effect.

Table 6.3: Impacts of SMP policy on the Outer Humber Estuary over the three epochs of the SMP as a result of a HTL Policy for Policy Units L-N in the absence of mitigation.

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Breeding birds			
Little tern (<i>Sterna albifrons</i>)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The main breeding tern colonies in Policy Units L - N are at Donna Nook and Tetney Marshes in Unit N. They will therefore be unaffected by coastal squeeze during Epoch 1 as they are distant from Policy Unit L.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. This will not significantly alter longshore transport of sediment to other parts of the estuary.</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Since Policy Unit N will still be accreting in Epoch 2 the tern colonies will not be adversely affected by habitat loss as a result of the HTL policy.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, this would be offset by dune expansion associated with continuing accretion in Unit N.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The habitat at Donna Nook and Tetney Marshes (Policy Unit N) will start to erode during this epoch as sea level rises and coastal defences are maintained. There will also be an increase in pressure on habitat within the inner and middle estuaries as birds are displaced.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>
Wintering waders and wildfowl, and passage waders			
153,934 waterfowl representing a range of species	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Most waterfowl use the intertidal mudflats and saltmarsh including that within Policy Unit L, although any impact will be restricted to local areas, mainly at the western end of Policy Unit L during Epoch</p>	<p>Adverse effect</p> <p>As for Epoch 1</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>Erosion will overtake accretion within Policy Unit L as sea level rises and coastal defences are maintained.</p> <p>The intertidal mudflats/sandflats in Policy</p>



Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
	<p>1. Coastal squeeze and loss of intertidal habitats may occur, especially between Immingham and Pywipe due to foreshore lowering, although there will be accretion in other areas within Unit L (principally the area sheltered by the docks).</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. This will not significantly alter longshore transport of sediment to other parts of the estuary.</p>		<p>Unit N will start to erode during this epoch as sea level rises and coastal defences are maintained. There will also be an increase in pressure on habitat within the inner and middle estuaries as birds are displaced.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>

Summary of adverse effects on the Humber Estuary SPA

L6.54 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies and that amendments to policy would be needed to either mitigate the effects or (mainly with regard to coastal squeeze) to facilitate compensatory habitat provision:

Epoch 1

- An adverse effect on SPA bird interest of The Lagoons SSSI (Easington Lagoons) as a result of a HTL policy in Policy Unit I resulting in coastal squeeze;
- A possible adverse effect on the SPA bird interest of the SAC due to loss of intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy; and
- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

L6.55 The coastal squeeze effects will act ‘in combination’ on the estuary as a whole with the HTL policies for the Inner and Middle Estuaries as set out in the Humber Flood Risk Management Strategy, which will also lead to coastal squeeze.

Epoch 2

- An adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether; and
- An adverse effect on the intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy. This reduction in habitat extent will in turn lead to a decline in the quantity of habitat available for the population of passage and wintering waterfowl in these areas.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

L6.56 The coastal squeeze effects will act ‘in combination’ on the estuary as a whole with the HTL policies for the Inner and Middle Estuaries as set out in the Humber Flood Risk Management Strategy, which will also lead to coastal squeeze.

Epoch 3

- A continuing adverse effect on the intertidal mudflats and pioneer saltmarsh in Policy Unit K (Spurn Bight and Welwick Marsh) as a result of a HTL policy. This will lead to a decline in the quantity of habitat available for the passage and wintering waterfowl populations for which this is a significant area. It may also increase the pressure on habitat elsewhere within the outer, middle and inner estuary as birds are displaced, or cause displacement from the estuary altogether.
- A continuing adverse effect on the intertidal mudflats and sandflats that lies within Policy Unit L as a result of coastal squeeze resulting from a HTL policy.
- An adverse effect on the large population of passage and wintering waterfowl that concentrates within Policy Unit N as a result of coastal squeeze due to a HTL policy; and
- An adverse effect throughout the Humber Estuary SPA as a result of increased erosion associated with a reduction in sediment deposition as a result of the coastal defences with Policy Unit L and Policy Unit M and Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast. It should be noted that this uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, the SMP Action Plan must include measures to further investigate and resolve this issue such that any revisions to policy can be made following the obtaining of further data. This is covered further in Chapter L13.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

L7 Appropriate Assessment: Humber Estuary Ramsar site

- L7.1 This Chapter documents the Appropriate Assessment of the Flamborough Head to Gibraltar Point SMP with regard to those Policy Units for which the preferred policy could not be screened out as ‘unlikely to lead to significant effects’ on the Humber Estuary Ramsar site. It must be noted that in order to avoid repetition this chapter only concerns itself with adverse effects on those species for which the estuary was designated as a Ramsar site and which have not already been covered under the SAC or SPA chapters – namely the population of Natterjack toad in Unit N.
- L7.2 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter L13 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur. Chapters L14 and L15 then address amendments that have been made to the final SMP policy in order to facilitate compensatory habitat creation triggered by those residual adverse effects. It should be noted that the ‘no alternatives’ and IROPI arguments that need to be made as part of the ‘IROPI case’ to the Secretary of State associated with the provision of compensatory habitat will be set out in a separate document.

Coastal squeeze

- L7.3 Coastal squeeze effects may begin to occur on dune habitats in Epoch 3 as sediment deposition becomes outpaced by sea level rise.

Effect of a HTL policy along sections of the Holderness Coast on the Humber Estuary Ramsar site

- L7.4 Impacts on the bird interest of the Ramsar site were considered in the previous chapter on the SPA. According to the sediment processes report, the HTL policy for Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast would result in the potential for some reduction in sediment supply during Epoch 3 if SMP policy was not amended to allow for the potential future release of sediment. It is therefore possible that adverse effects on natterjack toad dune habitat at Saltfleet may begin to occur during Epoch 3. The amendments made to allow for future sediment release are covered in Chapter L13.

In combination effects on Policy Unit N

- L7.5 No other projects and plans that may work in combination with the SMP have been identified as other plans and projects that may come on line in Epoch 3 are unknown at this point.

Summary of adverse effects on the Humber Estuary Ramsar site

L7.6 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies (note that Ramsar species and habitats that have already been covered as part of the SAC and SPA designations are not repeated below) and that amendments to policy would be needed to either mitigate the effects or (mainly with regard to coastal squeeze) to facilitate compensatory habitat provision:

Epoch 3

- An adverse effect on the large population of natterjack toad that concentrates at Saltfleet within Policy Unit N as a result of coastal squeeze due to a HTL policy.
- An adverse effect as a result of increased erosion associated with a reduction in sediment deposition within the outer estuary (including the Spurn peninsula) as a result of the coastal defences with Policy Unit L and Policy Unit M and Policy Units D, E (with regard to Mappleton), F and H along the Holderness coast.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;

Table 7.1: Impacts of SMP policy on the natterjack toad population of the Humber Estuary over the three epochs of the SMP as a result of a HTL Policy for Policy Unit N and HTL policies elsewhere in the estuary in the absence of mitigation.

Designated international interest feature	Coastal squeeze effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Natterjack toad (<i>Bufo calamita</i>)	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The interest features of the Humber Estuary Ramsar site essentially overlap with the SAC and SPA interest features already discussed, with one notable exception - the dune slacks at Donna Nook and at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site in Unit N are the most north-easterly breeding site in Great Britain of the natterjack toad <i>Bufo calamita</i>. However, no coastal squeeze effect will occur during Epoch 1.</p> <p><u>Sediment transport</u></p> <p>During Epoch 1 most sediment transport around the estuary would continue as present with only Policy Unit L experiencing a reduction in sediment release as the coastal defences prevent erosion. However, this will not significantly alter longshore transport of sediment to other parts of the estuary such as Unit N.</p>	<p>No adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The dunes within Policy Unit N are expected to continue accreting such that no adverse effect will result.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary. However, this would be offset by habitat expansion associated with continuing accretion in Unit N.</p>	<p>Adverse effect</p> <p><u>Coastal squeeze</u></p> <p>The beach habitat in Policy Unit N will start to erode during this epoch as sea level rises and coastal defences are maintained.</p> <p><u>Sediment transport</u></p> <p>The reduction in erosion (and thus sediment available) from Policy Unit L will be exacerbated and begin to affect long-shore transport to other parts of the outer estuary.</p>

L8 Appropriate Assessment – Saltfleetby – Theddlethorpe Dunes & Gibraltar Point SAC

- L8.1 The interest features of Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC are all essentially dependent on the persistence of the dune system and thus a situation in which the rate of accretion is greater than or equal to the rate of erosion. The majority of accumulated sand that forms the spit at Gibraltar Point is supplied via longshore transport along the Lincolnshire Coast and the nearshore sandbanks.
- L8.2 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter L13 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur.

Coastal squeeze and defence footprint

- L8.3 Improving flood defences can involve an increase in defence footprint although it is not possible to quantify at the SMP scale. However, it was recognised that policy wording needed to be incorporated into the SMP to ensure the defence footprint was kept as small as possible.
- L8.4 The other impacts on the SAC are summarised in Table 8.1. The HTL policy in Unit P will not result in adverse effects on the SAC during Epochs 1 and 2. However, during Epoch 3 it is possible that artificial and natural replenishment of sediment up-drift will fail to counterbalance the accelerating rate of sea level rise during this epoch, which would mean a reduction in the extent of dune and intertidal habitat. At this point the scale of any losses cannot be quantified. For this reason, the policy in Epoch 3 for Policy Unit P is conditional, allowing for MR; the accretion trend is expected to slow and potentially change to an erosional trend. Currently, there is not enough evidence to be able to firmly predict if and when this may happen. If this occurs, landward realignment needs to be considered as an alternative to holding the line.
- L8.5 While there may be adverse effects as a result of the East Lindsey Local Development Framework mainly as a result of potential for disturbance of waterfowl, this is of relevance only to the SPA, not the SAC. As such it will not interact with the Flamborough Head to Gibraltar Point SMP.

Sediment transport into the SAC

- L8.6 Due to accretion during the previous two epochs and increased input of sediment from accelerated erosion on the Holderness Cliffs, longshore transport into the Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC will continue despite a HTL policy for Policy Unit O. However, during Epoch 3, relative sea level rise will accelerate and begin to outpace deposition leading to foreshore steepening and erosion. It was therefore identified that amendments were required to SMP policy in order to facilitate potential MR and sediment release in Epoch 3.

Table 8.1: Impacts of SMP policy on the Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC in the absence of mitigation

Species for which the outer estuary is a key area	Effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (2005 – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Habitats			
Embryonic shifting dunes	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Adverse effect</p> <p>Increasing likelihood that the condition and extent of the sandflats, dunes and grazing marshes would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments only takes place at Gibraltar Point and at present day volumes would not be adequate to maintain the sandflats and dunes.</p>
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes') Fixed dunes with herbaceous vegetation ('grey dunes') Dunes with <i>Hippophae rhamnoides</i> Humid dune slacks	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Adverse effect</p> <p>Increasing likelihood that the condition and extent of the sandflats, dunes and grazing marshes would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments at present day volumes would not be adequate to maintain the sandflats and dunes.</p>

Summary of adverse effects Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC

L8.7 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies in the absence of mitigation and amendments to policy would be needed to mitigate the effects:

- Adverse effects from **Epoch 3** on the dune system through coastal squeeze as artificial replenishment of sediment up-drift and sediment transported from offshore fails to counterbalance the accelerating rate of sea level rise. This will occur as a result of the HTL policy in Units N and P;
- An adverse effect from **Epoch 3** on the dune system as sediment transport into the SAC declines due to a HTL policy for Policy Unit O.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;

L9 Appropriate Assessment – Gibraltar Point SPA

- L9.1 The interest features of Gibraltar Point SPA are all essentially dependent on the persistence of the dune system and thus a situation in which the rate of accretion is greater than or equal to the rate of erosion. The majority of accumulated sand that forms the spit at Gibraltar Point is supplied via longshore transport along the Lincolnshire Coast and the nearshore sandbanks.
- L9.2 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter L13 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur.

General disturbance of waterfowl

- L9.3 For the Habitat Regulations Assessment of the Medway and Swale SMP undertaken by the Environment Agency in consultation with Natural England, it was identified during the screening stage that since the physical extent and timing of works were outside the remit of the SMP (being defined at a subsequent date by individual schemes) disturbance-related adverse effects on those sites designated for their breeding or wintering bird interest was a potential '*generic effect controllable by conditions*' applicable to all policy options other than NAI in most locations. We have therefore made the same assumption. As such, it is not possible to conclude that the works required under the SMP policies will not result in adverse effects without mitigating measures.

Coastal squeeze and defence footprint

- L9.4 Improving flood defences can involve an increase in defence footprint although it is not possible to quantify at the SMP scale. However, it was recognised that policy wording needed to be incorporated into the SMP to ensure the defence footprint was kept as small as possible.
- L9.5 The other impacts on the SPA are summarised in Table 8.1. The HTL policy in Unit P will not result in adverse effects on the SPA during Epochs 1 and 2. However, during Epoch 3 it is possible that artificial and natural replenishment of sediment up-drift will fail to counterbalance the accelerating rate of sea level rise during this epoch, which would mean a reduction in the extent of dune and intertidal habitat. At this point the scale of any losses cannot be quantified. For this reason, the policy in Epoch 3 for Policy Unit P is conditional, allowing for MR; the accretion trend is expected to slow and potentially change to an erosional trend. Currently, there is not enough evidence to be able to firmly predict if and when this may happen. If this occurs, landward realignment needs to be considered as an alternative to holding the line.
- L9.6 There may be adverse effects as a result of the East Lindsey Local Development Framework mainly as a result of the potential for disturbance of waterfowl; these may act 'in combination' with any disturbance caused by works to maintain the defences unless these latter are timed sensitively with regard to the interest features of the SPA. Wording was therefore devised for the SMP or Action Plan to ensure that this sensitive timing takes place (see Chapter L13).

Sediment transport into the SPA

- L9.7 Due to accretion during the previous two epochs and increased input of sediment from accelerated erosion on the Holderness Cliffs, longshore transport into the Gibraltar Point SPA will continue despite a HTL policy for Policy Unit O. However, during Epoch 3, relative sea level rise will accelerate and begin to outpace deposition leading to foreshore steepening and erosion. It was therefore identified that amendments were required to SMP policy in order to facilitate potential MR and sediment release in Epoch 3.

Table 9.1: Impacts of SMP policy on Gibraltar Point SPA in the absence of mitigation

Species for which the outer estuary is a key area	Effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (2005 – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Breeding birds			
Little tern (<i>Sterna albifrons</i>)	<p>No adverse effect</p> <p>The breeding tern colonies are focussed on the dune ridges at Gibraltar Point.</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Adverse effect</p> <p>Increasing likelihood that the condition and extent of the sandflats, dunes and grazing marshes would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments at present day volumes would not be adequate to maintain the sandflats and dunes.</p> <p>The breeding tern colonies are focussed on the dune ridges at Gibraltar Point and as such can be expected to suffer from a reduction in extent due to coastal squeeze and reduction in sediment transport into the site.</p>



Species for which the outer estuary is a key area	Effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (2005 – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Wintering birds (high-tide roost)			
Bar-tailed godwit	No adverse effect	No adverse effect	Adverse effect
Knot	<p>The wintering colonies are spread across the saltmarsh, intertidal mudflats and dunes. The highest-tide roost is mainly on a shingle spit which constitutes the end point of a yellow dune ridge.</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Increasing likelihood that the condition and extent of the sandflats, dunes and grazing marshes would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments at present day volumes would not be adequate to maintain the sandflats and dunes.</p> <p>The wintering colonies are spread across the saltmarsh, intertidal mudflats and dunes and as such can be expected to suffer from a reduction in extent due to coastal squeeze and reduction in sediment transport into the site.</p>
Grey plover			



Species for which the outer estuary is a key area	Effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (2005 – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
<p>General wintering waterfowl assemblage</p> <p>53,072 waterfowl representing a range of species</p>	<p>No adverse effect</p> <p>Most waterfowl use the intertidal mudflats and saltmarsh.</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>No adverse effect</p> <p>The natural processes relating to the sand dunes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Adverse effect</p> <p>Increasing likelihood that the condition and extent of the sandflats, dunes and grazing marshes would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments at present day volumes would not be adequate to maintain the sandflats and dunes.</p> <p>Most waterfowl use the intertidal mudflats and saltmarsh. These birds will therefore lose habitat due to coastal squeeze and reduction in sediment transport into the site.</p>

Summary of adverse effects on Gibraltar Point SPA

L9.8 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies in the absence of mitigation and amendments to policy would be needed to mitigate the effects:

- Adverse effects from **Epoch 3** on the dune system (and therefore the bird interest of the SPA) through coastal squeeze as artificial replenishment of sediment up-drift and sediment transported from offshore fails to counterbalance the accelerating rate of sea level rise. This will occur as a result of the HTL policy in Units N and P;
- An adverse effect from **Epoch 3** on the dune system (and therefore the bird interest of the SPA), as sediment transport into the SPA declines due to a HTL policy for Policy Unit O.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;
- A disturbance impact on waterfowl when defences are being maintained if not appropriately timed.

L10 Appropriate Assessment – Gibraltar Point Ramsar site

- L10.1 The Gibraltar Point Ramsar site is designated for its sand dunes and bird population (considered under the preceding sections on the SAC and SPA) but also for its saltmarsh and freshwater marsh in addition to an assemblage of wetland invertebrate species of which eight species are listed as rare in the British Red Data Book and a further four species listed as vulnerable. The interest features of Gibraltar Point Ramsar site are all essentially dependent on the persistence of the dune system and thus a situation in which the rate of accretion is greater than or equal to the rate of erosion. The majority of accumulated sand that forms the spit at Gibraltar Point is supplied via longshore transport along the Lincolnshire Coast and the nearshore sandbanks.
- L10.2 It is considered important to be able to demonstrate how SMP policy evolved to incorporate amendments that were identified as being necessary to avoid or mitigate adverse effects, or (where necessary) facilitate the delivery of compensatory habitat. This Chapter therefore sets out the adverse effects that would arise from SMP policy in the absence of any such measures. Chapter L13 then details those amendments that were made to SMP policy to facilitate avoidance or mitigation of such effects and identifies whether residual adverse effects on integrity would still occur.

Coastal squeeze and defence footprint

- L10.3 Improving flood defences can involve an increase in defence footprint although it is not possible to quantify at the SMP scale. However, it was recognised that policy wording needed to be incorporated into the SMP to ensure the defence footprint was kept as small as possible.
- L10.4 The other impacts on the Ramsar site are summarised in Table 8.1. The HTL policy in Unit P will not result in adverse effects on the Ramsar site during Epochs 1 and 2. However, during Epoch 3 it is possible that artificial and natural replenishment of sediment up-drift will fail to counterbalance the accelerating rate of sea level rise during this Epoch, which would mean a reduction in the extent of saltmarsh habitat. At this point the scale of any losses cannot be quantified. For this reason, the policy in Epoch 3 for Policy Unit P is conditional, allowing for MR; the accretion trend is expected to slow and potentially change to an erosional trend. Currently, there is not enough evidence to be able to firmly predict if and when this may happen. If this occurs, landward realignment needs to be considered as an alternative to holding the line.
- L10.5 While there may be adverse effects as a result of the East Lindsey Local Development Framework mainly as a result of potential for disturbance of waterfowl, this has already been considered within the section on Gibraltar Point SPA.

Sediment transport into the Ramsar site

- L10.6 Due to accretion during the previous two epochs and increased input of sediment from accelerated erosion on the Holderness Cliffs, longshore transport into the Gibraltar Point Ramsar site will continue despite a HTL policy for Policy Unit O. However, during Epoch 3, relative sea level rise will accelerate and begin to outpace deposition leading to foreshore

steepening and erosion. It was therefore identified that amendments were required to SMP policy in order to facilitate potential MR and sediment release in Epoch 3.

Table 10.1: Impacts of SMP policy on Gibraltar Point Ramsar site in the absence of mitigation

Species for which the outer estuary is a key area	Effect from the Flamborough Head to Gibraltar Point SMP alone		
	Epoch 1 (2005 – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
Habitats			
Saltmarsh	<p>No adverse effect</p> <p>New saltmarsh is currently still forming. The natural processes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>No adverse effect</p> <p>The natural processes would largely continue, as in addition to natural sediment feed from updrift areas, maintenance of these features would also be assisted through artificial replenishment of sediment updrift at the same volumes as the present day.</p>	<p>Adverse effect</p> <p>Increasing likelihood that the condition and extent of the saltmarsh would reduce under this policy as sea level rise accelerates and the defence line is held. Artificial updrift beach sediment replenishments at present day volumes would not be adequate to maintain the saltmarsh.</p>
Freshwater marsh	<p>No adverse effect</p> <p>The freshwater marsh is isolated from the sea by the 'Bulldog Bank' flood defence. As such, the HTL policy will preserve this feature.</p>	<p>No adverse effect</p> <p>The freshwater marsh is isolated from the sea by the 'Bulldog Bank' flood defence. As such, the HTL policy will preserve this feature.</p>	<p>No adverse effect</p> <p>The freshwater marsh is isolated from the sea by the 'Bulldog Bank' flood defence. As such, the HTL policy will preserve this feature.</p>
Freshwater invertebrates	<p>No adverse effect</p> <p>The freshwater marsh in which these invertebrates are found is isolated from the sea by the Bulldog bank flood defence. As such, the HTL policy will preserve this feature.</p>	<p>No adverse effect</p> <p>The freshwater marsh in which these invertebrates are found is isolated from the sea by the Bulldog bank flood defence. As such, the HTL policy will preserve this feature.</p>	<p>No adverse effect</p> <p>The freshwater marsh in which these invertebrates are found is isolated from the sea by the Bulldog bank flood defence. As such, the HTL policy will preserve this feature.</p>

Summary of adverse effects on Gibraltar Point Ramsar site

L10.7 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies in the absence of mitigation and amendments to policy would be needed to mitigate the effects:

- Adverse effects from **Epoch 3** on the saltmarsh feature through coastal squeeze as artificial replenishment of sediment up-drift and sediment transported from offshore fails to counterbalance the accelerating rate of sea level rise. This will occur as a result of the HTL policy in Units N and P;
- An adverse effect from **Epoch 3** on the saltmarsh as sediment transport into the SAC/SPA declines due to a HTL policy for Policy Unit O.
- Landtake in all policy units where HTL is to be applied due to potential increases in defence footprint;

L11 The Wash & North Norfolk Coast SAC/ The Wash SPA & Ramsar site

L11.1 The habitat diversity of The Wash is largely dependent on physical processes that dominate the natural system; consequently the vulnerability of habitats is linked to changes in the physical environment. In particular, changes in the sediment budgets are known to be a risk to these habitats. Changes in the quantity of sediment entering the system from the Lincolnshire and East Yorkshire coasts will have important implications for the interest features of the area. Note that this chapter appraises the policies as they stood in 2009; any amendments to policy following HRA in order to specifically address matters raised in this Chapter are covered in Chapters L13 - L15.

Sediment regimes (long-shore transport into the site)

L11.2 The HTL policy for Policy Units N - P in particular (but also for Policy Units B D, E (partially, with regard to Mableton) F and H along the Holderness Coast) could result in a gradual decrease in the quantity of eroded sediment being deposited into The Wash in Epoch 3. Since the international interest features of The Wash SAC, SPA and Ramsar site are all more or less dependent on continuing sediment inputs, this could have an adverse effect on the designated sites, particularly when considered in combination with the coastal defences that will be maintained around the estuary under The Wash SMP itself.

L11.3 Over the three epochs of the SMP, the impact on sediment transport into The Wash will change as follows.

Table 11.1: Changes to sediment inputs to The Wash over the three epochs of the SMP

Epoch 1 (Present – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
In this epoch, the HTL policies would not result in an adverse effect since sediment supply and transport would not be materially altered over this short timescale. In particular, due to the distances involved there would be a considerable lag time between effects on The Wash as a result any reduction in sediment arising from the Holderness Coast.	As for Epoch 1	Habitats (and the species that depend upon them) which require substantial sediment inputs may be adversely affected if sediment inputs from Policy Units A, C, E, G, I, N, O and P decline. The scale of the effect is difficult to quantify at this distance since it would be dependent upon the actual mechanisms used to implement the HTL policies. For example, if beach nourishments cannot be upgraded sufficiently to match rising sea levels, effects will be of greater magnitude.

- L11.4 Royal Haskoning are undertaking the Wash SMP. They have summarised their preliminary conclusions about the intertidal development in the Wash if the current alignment for the estuary were held throughout the entire SMP period as follows³⁴:
- Epoch 1: A small overall increase of intertidal area, with some gain of saltmarsh at the expense of mudflat. This is based on extrapolation of current trends, and is relatively certain.
 - From Epoch 2 onward:
 - Either, at the accretional end of the scale, the total intertidal area is practically unchanged because the vertical growth of the mudflat keeps pace with sea level rise. The accretional approach also assumes continued growth of the saltmarsh (within the constraint of sediment availability). This then comes at the expense of mudflat area. The current ratio of 15% saltmarsh and 85% mudflat could change to an almost 50 / 50 ratio in Epoch 3; alternatively,
 - At the erosional end of the scale, the total intertidal area reduces because the mudflat experiences erosion while sea level rises. Within this total, assuming onset of saltmarsh erosion, the ratio of saltmarsh and mudflat could remain similar to the current situation.
- L11.5 In reality, the future situation of intertidal development in The Wash is likely to be a combination of these two scenarios.
- L11.6 It is not possible at this point to accurately quantify the actual volumetric change in sediment inputs to The Wash over time as there are too many variables involved, including the precise mechanism used to implement the HTL policies, which will not be decided until a later tier of coastal defence development. However, it is possible to conclude that a reduction in sediment inputs may therefore, from Epoch 3, constitute an adverse effect on the integrity of The Wash & North Norfolk Coast SAC, The Wash SPA and The Wash Ramsar site.

Summary of adverse effects on The Wash & North Norfolk Coast SAC/ The Wash SPA & Ramsar site

- L11.7 The Appropriate Assessment concluded that the following adverse effects might result from SMP policies in the absence of mitigation, particularly when considered in combination with the HTL policies contained within The Wash SMP, and amendments to policy would be needed to mitigate the effects:
- An adverse effect from **Epoch 3** due to the reduction in sediment inputs arising from a HTL policy in Policy Units B D, F, H and N - P.

³⁴ Information taken from unpublished Royal Haskoning note to the Wash SMP2 Client Steering Group 'Firming up Actions – Saltmarsh and mudflat evolution' (June 2009)

L12 Amendments Made to Policy to Facilitate Avoidance or Mitigation

L12.1 It was identified in the Appropriate Assessment process described in the preceding chapters that a series of amendments to SMP policy were required in order to facilitate the delivery of measures to avoid or mitigate adverse effects. This Chapter sets out the amendments that were made. It is also important to ensure that the SMP Action Plan contains any actions or research required to resolve uncertainties regarding adverse effects and that SMP policy retains sufficient flexibility to respond to the outcomes of Action Plan activities.

Humber Estuary SAC, SPA and Ramsar site

Avoidance - Epochs 1 and 2

L12.2 No measures that would avoid the coastal squeeze impacts stemming from HTL policies in Epoch 1 have been identified as being achievable. The only 'avoidance' measure (i.e. avoiding the coastal squeeze impact entirely) would require a policy of either NAI or MR to be adopted³⁵. It was therefore necessary to investigate mechanisms for compensatory habitat provision. These are discussed further in Chapter L13. The discussion of alternatives and Imperative Reasons of Overriding Public Interest which are necessary when compensatory habitat creation is being explored are set out in a separate document.

Mitigation for direct landtake and disturbance of waterfowl (all Epochs)

L12.3 While it was not possible to avoid or adequately mitigate coastal squeeze impacts, it was possible to make amendments to the SMP or Action Plan to enable the delivery of mitigation for direct defence footprint impacts or disturbance of waterfowl during defence construction works.

L12.4 A generally applicable measure that has been included in other adopted SMPs (particularly the Medway and Swale SMP) to ensure that the footprint of any coastal defence works and significant disturbance of SPA/Ramsar birds are avoided is the inclusion of words similar to '*works will be timed to avoid significant disturbance*'. This has therefore been introduced to the SMP document. This will also be important in addressing the 'in combination' disturbance effects that might otherwise arise.

L12.5 The following wording has also been incorporated into the SMP in order to address issues of defence footprint: '*The working areas for each flood defence scheme will be subject to detailed design in order to minimise the defence footprint. There will be no increase in defence footprint unless adverse effects on the integrity of European sites can be avoided, or unless there are no alternatives and an IROPI test is made and any compensatory habitat creation agreed*'. This is particularly important in addressing the impacts of the current difference between the SMP and HFRMS with regard to Policy Unit K.

L12.6 The SMP policy for Unit K involves the maintenance of defences; in contrast, the Humber Flood Risk Management Strategy states that maintenance will be withdrawn. It is possible therefore that the SMP will result in a small additional increase in habitat loss if the defence footprint is

³⁵ For the purposes of this report, setting back the coastal defences in an alternative location to allow an equivalent or greater area of habitat to be created outside the boundary of the internationally designated site is considered compensation within the meaning of the Habitats Directive

increased. However, it should be noted that maintaining the defences to P4 standard will not necessarily result in any increase in defence footprint, depending on the method chosen (sheet piling for example would result in a reduction in footprint). There will remain uncertainty over the exact method by which defences will be maintained until the relevant scheme is developed. However, the inclusion of the policy wording above would ensure that the overall footprint would not increase.

- L12.7 Although a significant adverse disturbance effect on the SPA interest features was identified during Epoch 1 when the SMP was considered ‘in combination’ with the Humber Flood Risk Management Strategy, East Yorkshire Local Development Framework and any future offshore windfarms, no additional mitigation needs to be delivered by the SMP since the timing of works to avoid the sensitive periods will effectively address the SMP’s contribution to the ‘in combination’ effect.

Mitigation to offset a reduction in sediment supply from the Holderness Coast (Epoch 3)

- L12.8 This issue relates to all European sites downstream of the Holderness Coast, although it is of greatest relevance to the Humber Estuary SAC, Humber Estuary SPA and Humber Estuary Ramsar site (including the inner and middle estuaries as well as the outer estuary). Best expert judgment in the sediment processes report has concluded that the HTL policy for Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness Coast is unlikely to result in a significant reduction in sediment supply until some point during Epoch 3, but it is recognised that there is no absolute certainty as to when adverse effects will commence. The quantity of sediment locked behind the defences has been established at 102,750 m³/yr. In addition, allowance will need to be made for sediment that will be trapped by the embayments and promontories that will begin to develop along the Holderness Coast in Epoch 3 and the increasing sediment demands of the Humber Estuary in the face of sea level rise.
- L12.9 The uncertainties that exist with regard to predicting the quantities of sediment that will need to be supplied to the Humber Estuary in particular to enable the maintenance of habitats and species must be explored in more detail from Epoch 1 in order that the SMP response can be informed by a better understanding of the issues before adverse effects occur. The SMP Action Plan must therefore include an action to further investigate this issue, commencing in Epoch 1. Any investigation would need to include exploration of the effectiveness of measures to avoid or mitigate this effect.
- L12.10 It is noted that in the view of Natural England the habitats on the Spurn Peninsula could not be adequately re-created elsewhere and therefore sediment release is the only viable option. Until the Action Plan study mentioned above is completed, a number of the SMP policies allow flexibility such that offsetting sediment release could be achieved, particularly in future epochs:
- Policy Unit E – This Policy Unit is NAI for most of its length. However during Epochs 1 and 2 it also includes a small section of HTL at Mappleton. This will be associated with monitoring of coastal processes to determine whether continuing to hold the line at Mappleton is still sustainable in Epoch 3. As such, the policy includes flexibility for consideration of other options to enable sediment release at Mappleton within Epoch 3;
 - Policy Unit H – This Policy Unit is HTL for current defences and NAI elsewhere. However, if planning permission for the defences is not extended or there was no longer a strategic need for the site, defences in front of Easington Gas Terminal could be removed and No

Active Intervention could then be undertaken. If this takes place it will contribute to a release of sediment from the Holderness Coast;

- L12.11 These would enable the reduction in sediment supply to be offset to a degree. It is understood that it would not be acceptable to adopt this same approach with regard to Policy Units B, D and F to allow future revision because this would jeopardise the defence of Bridlington, Hornsea and Withernsea. If additional sediment release from Policy Units E and H prove inadequate, sediment nourishment and/or (as a worst case scenario) compensatory habitat creation will need to be provided.
- L12.12 The volumes of sediment that would be held behind the defences of Units B, D and F or trapped due to the development of promontories are likely to make large scale sediment nourishment an unfeasible option either for practical reasons or for reasons of adverse environmental effect in the location from which the sediment is dredged. Therefore, the SMP needs to allow for the possibility that even after allowing sediment release from Units E and H and introducing small-scale sediment nourishment, it may be necessary to address sediment supply impacts on estuary habitats other than Spurn Peninsula by allowing for the creation of new habitat via MR during Epoch 3 if it proves necessary. This is mentioned further in the next Chapter

Trigger points

- L12.13 Since there is some uncertainty over the timing of adverse effects, it has been agreed with Natural England that the Action Plan would need to define ‘trigger points’ that would trigger the need to bring forward the provision of mitigation/habitat creation to an earlier point. The following initial key triggers are suggested (Table 13.1).

Table 13.1: Trigger points

Trigger for bring forward compensatory provision for declining sediment supply or coastal squeeze	Trigger point	Compensation that would be delivered and relevant Policy Unit for delivery
Declining sediment supply	Action Plan studies investigating the importance of sediment from the Holderness Coast conclude that adverse effects on the Humber Estuary will happen prior to Epoch 3.	Additional release of sediment from Holderness Coast (Units E and H), coupled with small scale sediment nourishment if sustainable.

Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC/ Gibraltar Point SPA & Ramsar site

Avoidance – Epoch 3

- L12.14 No measures that would completely avoid the sediment balance impacts stemming from HTL policies in Units O and P during Epoch 3 have been identified as being achievable. The only ‘avoidance’ measure would require a policy of total MR to be adopted. However, mitigation to offset a potential reduction in sediment supply in this Epoch is possible.

Mitigation for potential failure of sediment supply to offset sea-level rise (Epoch 3)

- L12.15 The SMP policy will address this through allowing for the need to adopt localised MR within Policy Units N, O and P to allow for continued supply of sediment from the south bank of the Humber and Lincolnshire coast if it proves necessary:
- Policy Unit N – The policy is HTL for all epochs, however, there is recognition that limited managed realignment of defences may occur within this policy unit to ensure sustainable defences and meet the requirements of environmental legislation;
 - Policy Unit O - This management intent will be carried out by a Hold the Line policy. Defences will need to be upgraded and improved over time to counter rising sea levels. Currently, beach nourishment occurs via the ongoing Lincshore scheme and this forms an important part of the defences. Beach nourishment can continue under this policy as currently it contributes effectively towards the HTL policy, as well as contributing to the sediment volume supplied to downdrift areas. In the longer term (Epoch 3), this policy allows for Managed Realignment to be considered locally, where appropriate during Epoch 3. This should include the consideration of sediment and its movement along the coast both on the beaches and in the nearshore area. Specific sites have not been identified, but further detailed studies in the future will investigate potential sites;
 - Policy Unit P - This management intent will be carried out by a Hold the Line policy. In the longer term (Epoch 3), this policy allows for Managed Realignment to be considered locally, where appropriate during Epoch 3. This should include the consideration of sediment and its movement along the coast both on the beaches and in the nearshore area. Specific sites have not been identified, but further detailed studies in the future will investigate potential sites.

Mitigation for direct landtake and disturbance of waterfowl (all Epochs)

- L12.16 It was possible to make amendments to the SMP or Action Plan to enable the delivery of mitigation for direct defence footprint impacts or disturbance of waterfowl during defence construction works.
- L12.17 A generally applicable measure that has been included in other adopted SMPs (particularly the Medway and Swale SMP) to ensure that the footprint of any coastal defence works and significant disturbance of SPA/Ramsar birds are avoided is the inclusion of words similar to '*works will be timed to avoid significant disturbance*'. This has therefore been introduced to the SMP document. This will also be important in addressing the 'in combination' disturbance effects that might otherwise arise.
- L12.18 Although a significant adverse disturbance effect on the SPA interest features was identified during Epoch 1 when the SMP was considered 'in combination' with the East Lindsay Local Development Framework, no additional mitigation needs to be delivered by the SMP since the timing of works to avoid the sensitive periods will effectively address the SMP's contribution to the 'in combination' effect.
- L12.19 The following wording has also been incorporated into the SMP in order to address issues of defence footprint: '*The working areas for each flood defence scheme will be subject to detailed design in order to minimise the defence footprint. There will be no increase in defence footprint*'

unless adverse effects on the integrity of European sites can be avoided, or unless there are no alternatives and an IROPI test is made and any compensatory habitat creation agreed'.

The Wash & North Norfolk Coast SAC / The Wash SPA/ The Wash Ramsar site

Avoidance – Epoch 3

- L12.20 No measures that would completely avoid the sediment balance impacts stemming from HTL policies in Units O and P during Epoch 3 have been identified as being achievable. The only 'avoidance' measure would require a policy of total MR to be adopted. However, mitigation to offset a potential reduction in sediment supply in this Epoch is possible.

Mitigation for reduction in sediment supply from the Holderness Coast and Lincolnshire Coast

- L12.21 Addressing the issue of a potential decline in sediment supply from the Holderness Coast and Lincolnshire Coast after Epoch 2 (bearing in mind that this will also be within the context of increasing sediment requirements within The Wash in response to rising sea levels) is largely within the hands of The Wash SMP since the Flamborough Head to Gibraltar Point SMP has no direct control over the actual mechanisms that might be deployed in The Wash to replenish sediment or provide compensatory habitat. However, since sediment supplies into The Wash from the north arise from the SMP area it is within the remit of the SMP to consider these issues.
- L12.22 The SMP will adopt the following policies to ensure that the SMP area continues to contribute sediment to The Wash during Epoch 3:
- Policy Units A, C, E (except for Mappleton) and G – These are all along the Holderness Coast and are No Active Intervention, which will ensure the continued feed of sediment to down-drift areas, thus helping to maintain important features such as Spurn, and the supply of sediment to the Humber and Lincolnshire coast;
 - Policy Unit E – This Policy Unit is NAI for most of its length. However during Epochs 1 and 2 it also includes a small section of HTL at Mappleton. This will be associated with monitoring of coastal processes to determine whether continuing to hold the line at Mappleton is still sustainable in Epoch 3. As such, the policy includes flexibility for a change in policy to NAI to release more sediment from the Holderness Coast at Mappleton within epoch 3;
 - Policy Unit H – This Policy Unit is HTL for current defences and NAI elsewhere. However, if planning permission for the defences is not extended or there was no longer a strategic need for the site, defences in front of Easington Gas Terminal could be removed and No Active Intervention could then be undertaken. If this takes place it will contribute to a release of sediment from the Holderness Coast;
 - Policy Unit N – The policy is HTL for all epochs, however, there is recognition that limited managed realignment of defences may occur within this policy unit to ensure sustainable defences and meet the requirements of environmental legislation;
 - Policy Unit O - This management intent will be carried out by a Hold the Line policy. Defences will need to be upgraded and improved over time to counter rising sea levels. Currently, beach nourishment occurs via the ongoing Lincshore scheme and this forms an

important part of the defences. Beach nourishment can continue under this policy as currently it contributes effectively towards the HTL policy, as well as contributing to the sediment volume supplied to downdrift areas. In the longer term (Epoch 3), this policy allows for Managed Realignment to be considered locally, where appropriate during Epoch 3. This should include the consideration of sediment and its movement along the coast both on the beaches and in the nearshore area. Specific sites have not been identified, but further detailed studies in the future will investigate potential sites;

- Policy Unit P - This management intent will be carried out by a Hold the Line policy. In the longer term (Epoch 3), this policy allows for Managed Realignment to be considered locally, where appropriate during Epoch 3. This should include the consideration of sediment and its movement along the coast both on the beaches and in the nearshore area. Specific sites have not been identified, but further detailed studies in the future will investigate potential sites.

L13 Appropriate Assessment Conclusion following incorporation of mitigation

- L13.1 The incorporation of the above mitigation measures do enable us to conclude that there will be no adverse effect on any European sites through disturbance of waterfowl or reduction in sediment supply as a result of SMP policies. However, the mitigation measures above do not enable us to conclude that coastal squeeze impacts on the Humber Estuary SAC, SPA or Ramsar site will be either avoided or mitigated to such an extent that they can be described as 'unlikely to be significant'.
- L13.2 It was therefore necessary for additional policy wording to be devised that would facilitate the delivery of compensatory habitat in appropriate policy units within the outer Humber Estuary. As part of that process it is also necessary for an evaluation of alternatives to maintaining the defences is made and for a justification for adopting the policy despite the adverse effects to be made on the basis of Imperative Reasons of Overriding Public Interest. The 'no alternatives' and 'IROPI' justifications are contained in a separate document to be produced shortly. The amendments to policy which have been made to facilitate the delivery of compensatory habitat are covered in Chapter L13 (relating to Epochs 1 and 2) and Chapter L14 (relating to Epoch 3).

L14 Amendments made to policy to facilitate compensatory habitat to be provided through the HFRMS in Epochs 1 and 2

- L14.1 The HRA of the SMP identified several potential adverse effects on the Humber Estuary European sites in Epochs 1 and 2 that would require the delivery of compensatory habitat creation. However, with the exception of the small difference regarding Policy Unit K addressed in the previous Chapter, the SMP policy is identical to the policy for the same area within the Humber Flood Risk Management Strategy (HFRMS). The adopted (2005) Humber Estuary Coastal Habitat Management Plan (CHaMP; which identifies the habitat creation for the policies in the HFRMS) clearly states (page 18) that '*The Humber Estuary CHaMP considers the impacts of the proposed flood defence works on shoreline evolution over the next 50 years (i.e. coastal squeeze). It also considers the impacts of the flood defence works themselves e.g. losses arising from reconstruction and maintenance works*'. This matches the two impacts which the HRA of the SMP undertaken in 2009 identified as requiring compensatory provision during Epochs 1 and 2.
- L14.2 It was agreed in meetings with the Environment Agency and Natural England that in such circumstances the compensatory habitat creation (CHaMP) being developed for the HFRMS would be adequate to also address the SMP impacts. The 'no alternatives' and IROPI arguments that need to be made as part of the 'IROPI case' to the Secretary of State will be set out in a separate document.
- L14.3 The CHaMP also makes clear the stance taken regarding sediment supply issues in Epochs 1 and 2: '*... it has been assumed that the future rates of sediment supply from Holderness will be similar to present day rates for the next fifty years*'. This fits with the assumptions that the SMP has taken with regard to sediment supply over the same time period (i.e. up to the start of Epoch 3).
- L14.4 Compensatory habitat creation that is not covered by the HFRMS habitat creation package as it currently stands relates solely to Epoch 3. The approach to dealing with this in Epoch 3 is covered in Chapter L15.

Epoch 1

Adverse effects on Easington Lagoons (Unit I) due to coastal squeeze

- L14.5 The Humber Flood Risk Management Strategy and Environment Agency studies concerning The Lagoons SSSI at Easington have already determined that compensatory provision will be required in the Humber Estuary from Epoch 1 as a result of coastal defence works in Policy Unit I. According to the Environment Agency report 'The Lagoons: N2K Long Term Plan & Options Development Report', the replacement habitat requirements are as set out in Table 14.1 below **Error! Reference source not found.**

Table 14.1: Replacement habitat requirements for The Lagoons SSSI (after Environment Agency, 2009)

Period	Change in SPA Area (ha)	Habitat Feature & Attributes	Replacement requirement
2008 To 2018	24.5 (-5.7) 18.8	Loss of high tide roost function of southern lagoon on extreme tides and general roosting viability of northern lagoon.	By 2010: At least 6ha of open landscape within or adjacent to the outer Humber Estuary containing functioning habitat to support roosting populations of redshank, knot and dunlin.
2018 to 2038	18.8 (-18.8ha) 0	Loss of breeding little tern interest. Loss of high tide roost provided by the southern lagoon.	By 2018: At least 6ha ³⁶ supporting functioning habitat of sand, shingle, shell or bare ground set within an open landscape. The habitat should be within or adjacent to the outer Humber Estuary and provide support for up to 39 breeding pairs of little tern. At least 19ha of open landscape within or adjacent to the outer Humber Estuary containing functioning habitat to support roosting populations of redshank, knot and dunlin.

L14.6 It should be noted that the provision for replacement habitat assumes that habitat is replaced on a 1:1 ratio. In order to provide an appropriate extent of functioning habitat to counter the deterioration of The Lagoons for the period 2008-2018 a number of measures over the short term are likely to be required. According to the Environment Agency report, these initial measures are to be implemented over the course of next two years in order to avoid the anticipated deterioration of the high tide roost function provided by specifically on extreme high tide in the northern lagoon.

L14.7 Based on a high level review of potential habitat replacement sites and measures undertaken on behalf of the Environment Agency the following conclusions have been drawn:

- The creation or improvement of arable and wet grassland habitats alone or in combination are unlikely to provide the necessary habitats that will provide support for the N2K Interest in conjunction with the remaining habitats at The Lagoons over the next 10 years.
- The creation of freshwater or saline complexes of scrapes, islands or spits may provide potential support to the interest features of The Lagoons over the short term. This likelihood will be improved if undertaken in conjunction with the improvement or creation of connected open wet grassland or winter arable landscapes.
- Although various possible locations have been explored, an acceptable solution has not yet been found. The Environment Agency report concludes that should a suitable location for habitat replacement not be identified alternative sites within the outer Humber Estuary will need to be identified. It may be possible to incorporate suitable habitat features within proposed MR sites already identified to counter predicted deterioration at The Lagoons which cannot be addressed by short term replacement habitat within the Easington flood cell.

³⁶ SPA habitat change figures taken from the outcomes of the N2K report

L14.8 The report also notes that further measures will be required to be in place by 2018 to counter the anticipated loss of function of The Lagoons as a little tern breeding site and for the loss of the high tide roost function provided by the southern lagoon. Such measures are not considered further within that report. However the report does anticipate that such replacement requirements will be addressed through the delivery of the planned MR schemes in the outer Humber Estuary. The delivery of this habitat creation during Epoch 1 is facilitated by the SMP policies for Units K and N of the Humber Estuary. The policy wording for both Units states that *'To ensure sustainable flood defence and to meet the requirements of environmental legislation, detailed studies will identify sites for limited managed realignment in the order of 100 hectares on the north [or in the case of Unit N, south] bank of the Humber Estuary'*.

L14.9 This policy for Unit K will enable additional habitat to be provided to replace the loss of the high-tide roost function of The Lagoons, while the policy for Unit N will enable the creation of replacement shingle habitat in a policy unit in which little terns have previously been known to nest provided that it is clear that in this latter case Managed Realignment will involve more active habitat creation than simply retreating defences. In addition Natural England have identified that it will be necessary for little terns to be recorded using the new shingle habitat before the habitat loss is identified to occur (i.e. before 2018)

Adverse effects on intertidal mudflats and saltmarsh and habitat for wintering waterfowl in Policy Units K and L due to coastal squeeze

L14.10 The following sections present information concerning the habitat creation which has already been devised to date (taken from the Humber Flood Risk Management Strategy and Easington Lagoons studies being undertaken by the Environment Agency) for coastal defences in the SMP area. The Strategy and its 'balance sheet' set out the Environment Agency's proposed compensatory measures over the next 50 years. The scale of provision for the outer estuary is based on the following commitments:

- to replace any direct loss of intertidal habitat from the works, based on a 3:1 ratio;
- to replace any intertidal habitat temporarily disturbed from the works, based on a 1:1 ratio;
- to replace any intertidal habitat lost to coastal squeeze, based on a 1:1 ratio;
- the compensatory habitat will be created in the same part of the Estuary (inner, middle or outer) in which it had been lost;
- monitoring habitat losses and gains over the life of the Strategy and revision of the habitat gains and losses calculations (by updating the 'balance sheet') with the latest monitoring information at least every five years through the Environment Agency's MR (and habitat creation) programme; and
- the compensatory measures and habitat creation schemes and their programme will be adjusted as necessary so that the overall gains and losses in the 'balance sheet' will always be positive. In other words, any defence works that damage the internationally important wildlife sites will not be carried out until the replacement habitat has been delivered in the appropriate part of the estuary. Likewise, losses to coastal squeeze will be addressed through compensation so that the balance of gains and losses remains positive.

L14.11 The 3:1 habitat replacement ratio quoted in the Coastal Habitat Management Plan (CHaMP) for direct losses from flood defence works inherently makes an allowance for any delay in development of the quality of the replacement habitat.

L14.12 The habitat losses and scale of habitat creation for Epoch 1 are summarised in Table 14.2 for ease of reference.

Table 14.2: Habitat losses and compensation during Epoch 1

Location of losses and habitat creation	Habitat lost in Epoch 1 (up to 2025)	Habitat to be created in Epoch 1 (up to 2025)
Humber Estuary as a whole, as calculated by the Humber Flood Risk Management Strategy ³⁷	295.6ha	346.8ha
<u>Inner and middle</u> Humber Estuary	211.6ha	249.9ha
<u>Outer</u> Humber Estuary	84.0ha	96.9ha

L14.13 In summary, the Humber Flood Risk Management Strategy calculates that approximately 80 ha of habitat losses in the Outer Estuary during Epoch 1 will be balanced by approximately 100 ha of habitat creation during Epoch 1. This will offset the losses of habitat in the outer estuary due to direct landtake and coastal squeeze. Additional realignment schemes will continue to be sought in the Strategy as opportunities arise.

L14.14 SMP policy will enable this through the preferred policy for Policy Units K and N which both allow for MR during Epoch 1. The policy wording for both Units states that *'To ensure sustainable flood defence and to meet the requirements of environmental legislation, detailed studies will identify sites for limited managed realignment in the order of 100 hectares on the north [or in the case of Unit N, south] bank of the Humber Estuary'*;

L14.15 Although a significant adverse effect on the SAC interest features was identified during Epoch 1 when the SMP was considered 'in combination' with the Humber Flood Risk Management Strategy, East Yorkshire Local Development Framework and any future offshore windfarms, no additional mitigation needs to be delivered by the SMP since the habitat creation mentioned in this section will effectively address the SMP's contribution to the 'in combination' effect.

Epoch 2

Delivery of long-term habitat creation for effects on the Lagoons SSSI

L14.16 The delivery of this compensation during Epoch 2 is addressed by the policy for Policy Unit I. This Policy Unit is HTL (P3) for the current defences with NAI elsewhere, across all 3 Epochs, but the Policy comments make it clear that options other than HTL in Epochs 2 and 3 may be considered subject to monitoring of coastal processes, future studies and third party decisions and that limited MR may occur, informed by the Humber Flood Risk Management Strategy. This would enable the provision of replacement for the Easington Lagoons habitat which will enable habitat creation to be provided for the long term preservation of the interest features of Easington Lagoons.

Adverse effects on SAC habitats and habitat for wintering SPA waterfowl in Policy Units K and L due to coastal squeeze

L14.17 The following sections present information concerning the compensatory provision which has already been devised to date (taken from the Humber Flood Risk Management Strategy and Easington Lagoons studies being undertaken by the Environment Agency) for coastal defences in the SMP area. The Strategy and its 50 year 'balance sheet' set out the Environment Agency's proposed compensatory measures over the next 50 years.

³⁷ Source: Humber Flood Risk Management Strategy. 2009. Halcrow on behalf of the Environment Agency; data supplied in July 2009

L14.18 The habitat losses and scale of habitat compensation provision described above for Epoch 2 are summarised in Table 14.3 for ease of reference.

Table 14.3: Habitat losses and compensation during Epoch 2

Location	Habitat lost in Epoch 2 (2025-2055)	Habitat Created in Epoch 2 (2025-2055)
Humber Estuary as a whole, as calculated by the Humber Flood Risk Management Strategy ³⁸	536.2ha	574.5ha
Inner and middle Humber Estuary	376.9ha	407.1ha
Outer Humber Estuary	159.3ha	167.8ha

L14.19 In summary, the Humber Flood Risk Management Strategy calculates that approximately 160 ha of habitat losses in the Outer Estuary during Epoch 2 will be balanced by with approximately 170 ha of habitat creation during Epoch 2. This will offset the losses of habitat in the outer estuary due to direct landtake and coastal squeeze. Additional realignment schemes will continue to be sought in the Strategy as opportunities arise.

L14.20 SMP policy enables this through the preferred policy for Policy Units K and N, as for Epoch 1, since these both allow for MR during Epoch 2.

³⁸ Source: Humber Flood Risk Management Strategy. 2009. Halcrow on behalf of the Environment Agency; data supplied in July 2009

L15 Amendments made to policy to facilitate any need for compensatory provision in Epoch 3 with regard to the Humber Estuary SAC, SPA & Ramsar site

L15.1 The 2009 Appropriate Assessment of the SMP identified that adverse effects due to coastal squeeze could not be ruled out in Epoch 3 based upon the preferred policies as they were worded at that time.

Loss of intertidal habitat in Units K, L, M and N due to coastal squeeze

L15.2 The Humber Flood Risk Management Strategy does not progress beyond the end of Epoch 2. As such, the details of compensatory habitat creation such as quantity have not yet been determined. However, the SMP needs to make provision for this habitat creation to be delivered during Epoch 3 once the quantities have been calculated. It is not possible to be precise as to actual quantities of loss and gain but based on predicted losses in the outer estuary during Epochs 1 and 2 is likely to be at least as much again and will probably be greater due to accelerating rates of sea level rise. It has been agreed with Natural England and the Environment Agency that xx ha is probably a realistic worst case figure at this stage

L15.3 The SMP policy has been amended to address this through the preferred policies for Policy Units K, M (to a small extent) and N, since these all allow for MR during Epoch 3. Managed Realignment in Unit N will not only permit intertidal habitats to migrate inland (thus providing compensatory intertidal sandflat for the grey seals at Donna Nook) but will also enable the inland migration of sand dune habitat in order to compensate for any loss of dune habitat for natterjack toads elsewhere in the Policy Unit.

L15.4 It is not possible so far in advance to undertake a detailed feasibility study at this stage concerning the potential for finding additional areas for managed realignment in Epoch 3 of the same extent as those identified in Epochs 1 and 2, but the 2 key Policy Units within which this managed realignment/habitat creation will be delivered (K and N) are both largely unconstrained by development, consisting primarily of farmland. There is thus no reason at this stage to conclude that it would not be physically possible to deliver the necessary managed realignment in these Policy Units.

Possible compensation that might required before the end of Epoch 3 to assist in offsetting increased intertidal habitat losses due to reduced sediment supply

L15.5 The volumes of sediment that would be held behind the defences of Units B, D and F or trapped due to the development of promontories are likely to make large scale sediment nourishment an unfeasible option either for practical reasons or for reasons of adverse environmental effect in the location from which the sediment is dredged. Therefore, the SMP needs to allow for the possibility that even after allowing sediment release from Units E and H and introducing small-scale sediment nourishment, it may be necessary to address sediment

- supply impacts on estuary habitats other than Spurn Peninsula by allowing for the creation of new habitat via MR during Epoch 3 if it proves necessary.
- L15.6 If compensatory habitat creation is required to supplement additional sediment release and nourishment, this will need to take the form of a new area of managed realignment in a location that is rendered less vulnerable to sediment supply issues. These locations could be within the inner and middle estuaries or within the outer estuary in policy units K or N (which already allow for the provision of managed realignment) with the realignment designed to maximise sediment capture.
- L15.7 It is not possible to estimate with any accuracy the scale of habitat creation required as compensation at this stage, particularly since in practice it may prove unnecessary to deliver it at all. Therefore this must be resolved through the Action Plan study identified above. In order to comply with the Habitats Directive, the compensatory areas would ideally need to be provided before a significant decline in sediment supply occurred (i.e. early in Epoch 3 based on current predictions, to be refined by the detailed Action Plan study).
- L15.8 It has been agreed with Natural England and the Environment Agency that since the likelihood that this impact may occur (and thus compensatory provision need to be delivered) is so uncertain there is no requirement for this particular impact to be subject to IROPI until a later stage of SMP or HFRMS revision, provided that further studies to investigate sediment supply in Epoch 3 are undertaken as part of the Action Plan.

Trigger points

- L15.9 Since there is some uncertainty over the timing of adverse effects, it has been agreed with Natural England that the Action Plan would need to define ‘trigger points’ that would trigger the need to bring forward the provision of mitigation/habitat creation to an earlier point. The following initial key triggers are suggested (Table 13.1). The tools for delivery of these habitat creation measures are the Humber Flood Risk Management Strategy and (potentially) the Environment Agency’s Regional Habitat Creation Scheme. In order to comply fully with the Habitats Directive and provide sufficient certainty that measures are in place that will cover the potential uncertainty over the exact timing of effects, it will therefore be essential for the Action Plan to incorporate these trigger points and undertake the identified monitoring actions over the period leading to Epoch 3.

Table 14.1: Trigger points

Trigger for bring forward compensatory provision for declining sediment supply or coastal squeeze	Trigger point	Compensation that would be delivered and relevant Policy Unit for delivery
Rate of habitat creation does not exceed rate of habitat loss, informed by annual monitoring from adoption.	The Humber Flood Risk Management Strategy and Coastal Habitat Management Plan identify a scale of habitat creation in each year which is required to ensure that the quantum of habitat being created keeps pace with the quantum of habitat lost. The trigger would therefore be if annual reporting associated with the Humber	Bring forward delivery of compensatory habitat creation in order to restore the required ratio.

Trigger for bring forward compensatory provision for declining sediment supply or coastal squeeze	Trigger point	Compensation that would be delivered and relevant Policy Unit for delivery
	Flood Risk Management Strategy identified that this ratio was declining.	

L16 Final Report Conclusion

- L16.1 With the adoption of the policy wording detailed in Chapters L12 it can be concluded that there will be no adverse effect on any European sites through disturbance of waterfowl or reduction in sediment supply as a result of SMP policies and no adverse effects on Saltfleetby to Theddlethorpe Dunes & Gibraltar Point SAC, Gibraltar Point SPA or Gibraltar Point Ramsar site.
- L16.2 The mitigation measures in that Chapter do not enable us to conclude that coastal squeeze impacts on the Humber Estuary SAC, SPA or Ramsar site will be either avoided or mitigated to such an extent that they can be described as 'unlikely to be significant'. It is therefore necessary for the competent authority to make a case for a) no alternatives and b) Imperative Reasons of Overriding Public Interest to the Secretary of State.
- L16.3 In order to make the 'IROPI case' it was necessary for additional policy wording to be devised that would facilitate the delivery of an adequate scale of compensatory habitat in appropriate policy units within the outer Humber Estuary. This has been accomplished as described in Chapters L14 and L15 in discussion with Natural England and the Environment Agency. As part of the IROPI process it is also necessary for an evaluation of alternatives to maintaining the defences to be made and for a justification for adopting the policy despite the adverse effects to be made on the basis of Imperative Reasons of Overriding Public Interest. The 'no alternatives' and 'IROPI' justifications are contained in a separate document to be produced shortly.

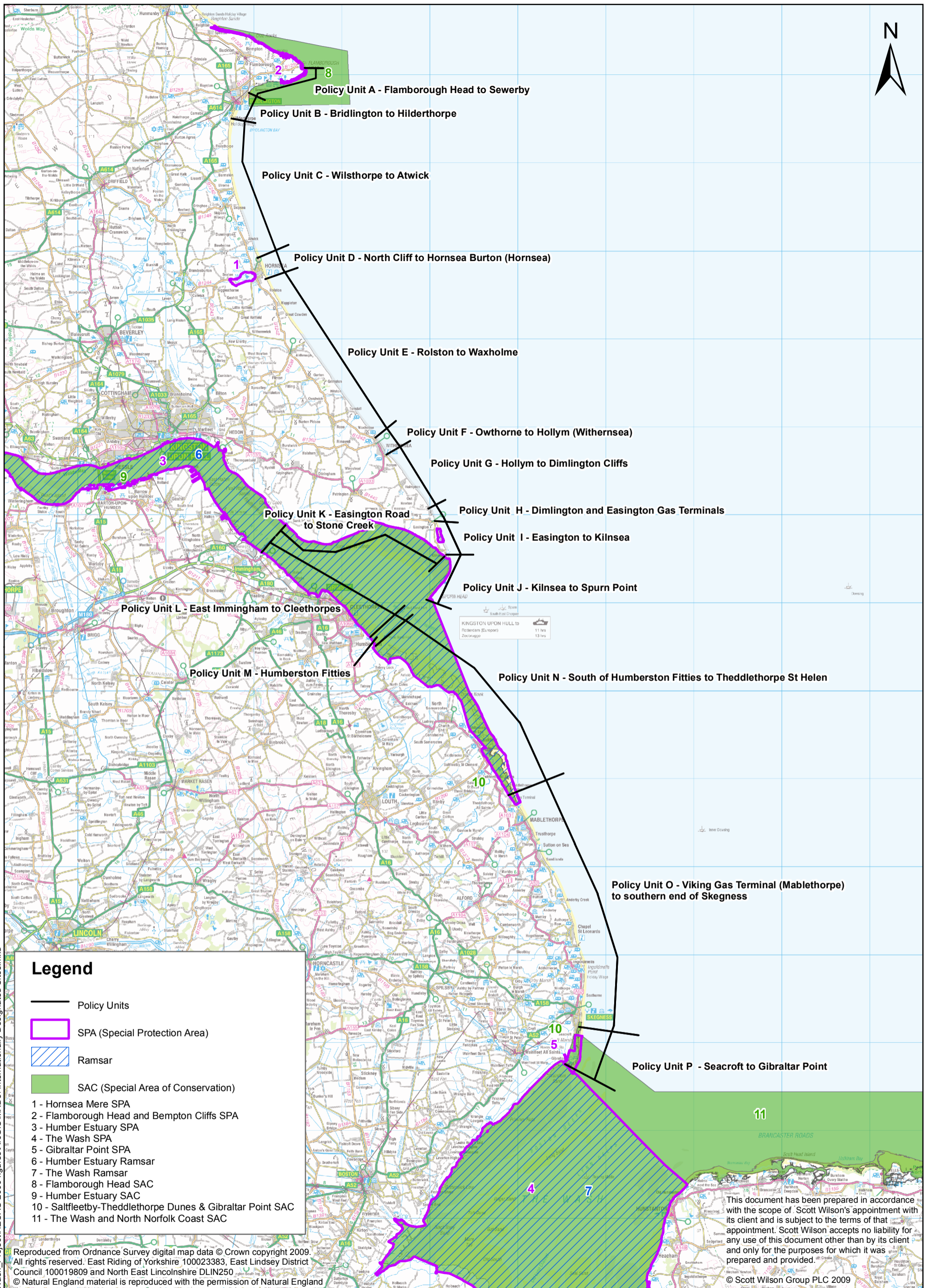
L17 Appendix 1 – Summary of measures requiring insertion into the Action Plan

L17.1 It is also important to ensure that the SMP Action Plan contains any actions or research required to resolve uncertainties regarding adverse effects and that SMP policy retains sufficient flexibility to respond to the outcomes of Action Plan activities. The following items have been identified through the HRA as being necessary for inclusion in the Action Plan:

- According to the sediment processes report, the HTL policy for Policy Units B, D, E (with regard to Mappleton), F and H along the Holderness coast may result in the potential for some reduction in sediment supply during Epoch 3. It should be noted that this uses best expert judgment and that there is no absolute certainty as to when adverse effects will commence. Therefore, the policies or the SMP Action Plan will need to ensure that measures to further investigate and resolve this issue are in place such that any revisions to policy can be made following the obtaining of further data.
- A form of words should be devised for the SMP Action Plan which addresses the issues of disturbance of waterfowl and increased defence footprint, such as *'works will be timed to avoid significant disturbance and the working area will be subject to detailed assessment to avoid damage'*.
- The wording *'Where 'HTL' schemes are implemented, the outline and detailed designs will avoid any adverse impact on internationally important wildlife sites unless the tests set out in the Conservation of Habitats and Species Regulations 2010 can be met'* should be inserted into the Action Plan.
- The uncertainties that exist with regard to predicting the quantities of sediment that will need to be supplied to the Humber Estuary in particular to enable the maintenance of habitats and species must be explored in more detail from Epoch 1 in order that the SMP response can be informed by a better understanding of the issues before adverse effects occur. The SMP Action Plan must therefore include an action to further investigate this issue, commencing in Epoch 1. Any investigation would need to include exploration of the effectiveness of measures to avoid or mitigate this effect.
- The Action Plan would need to define 'trigger points' that would trigger the need to bring forward the provision of mitigation/habitat creation to an earlier point. The following initial key triggers are suggested below:

Trigger for bring forward compensatory provision for declining sediment supply or coastal squeeze	Trigger point	Compensation that would be delivered and relevant Policy Unit for delivery
Declining sediment supply	Action Plan studies investigating the importance of sediment from the Holderness Coast conclude that adverse effects on the Humber Estuary will happen prior to Epoch 3.	Additional release of sediment from Holderness Coast (Units E and H), coupled with small scale sediment nourishment if sustainable.
Rate of habitat creation does not exceed rate of	The Humber Flood Risk Management Strategy and	Bring forward delivery of compensatory habitat creation

Trigger for bring forward compensatory provision for declining sediment supply or coastal squeeze	Trigger point	Compensation that would be delivered and relevant Policy Unit for delivery
habitat loss	Coastal Habitat Management Plan identify a scale of habitat creation in each year which is required to ensure that the quantum of habitat being created keeps pace with the quantum of habitat lost. The trigger would therefore be if annual reporting associated with the Humber Flood Risk Management Strategy identified that this ratio was declining.	in order to restore the required ratio.



Legend

- Policy Units
- SPA (Special Protection Area)
- Ramsar
- SAC (Special Area of Conservation)

- 1 - Hornsea Mere SPA
- 2 - Flamborough Head and Bempton Cliffs SPA
- 3 - Humber Estuary SPA
- 4 - The Wash SPA
- 5 - Gibraltar Point SPA
- 6 - Humber Estuary Ramsar
- 7 - The Wash Ramsar
- 8 - Flamborough Head SAC
- 9 - Humber Estuary SAC
- 10 - Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC
- 11 - The Wash and North Norfolk Coast SAC

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Project Title

HECAG SMP

FIGURE 1

Scale at A4: 1:400,000

Drawing Title

INTERNATIONALLY DESIGNATED WILDLIFE SITES IN RELATION TO EACH POLICY UNIT

Drw: AH

App: JR

Rev:

Chk:

Date: 12/08/09

Date: 12/08/09



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