

The Wash Shoreline Management Plan 2

Gibraltar Point to Old Hunstanton

Borough Council of
King's Lynn &
West Norfolk



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Glossary of terms

Term	Definition
Accretional	Describes land that grows due to natural forces. Accretion includes the addition of sand to a beach by ocean current, or the extension of a flood plain through the deposition of sediments by repeated flooding.
Adaptation	<p>The process of becoming adjusted to new conditions in a way that makes individuals, communities or systems better suited to their environment. Adaptation implies that there may be some actual change in the way a feature, such as a habitat or a community, functions. In supporting adaptation, management has to recognise certain principles:</p> <ul style="list-style-type: none"> • that adaptation may take time and may evolve slowly so that change to the overall community does not happen immediately; • that management should not encourage a progressively more vulnerable situation to develop, where there is a sudden change from one condition to another; and • that specific aspect of a feature, such as individual properties or elements of habitat may change or be lost, but without substantial loss to the value of the community or the overall ecological function of the feature.
Agricultural land classification	Classification of the quality of agricultural land as a grade from 1 (best quality) to 5 (poorest quality).
Area of Outstanding Natural Beauty	A statutory designation under the Countryside and Rights of Way Act 2000. The purpose of the AONB designation is to identify areas of national importance and to promote the conservation and enhancement of natural beauty. This includes protecting its flora, fauna, geological and landscape features.
Baseline scenarios	Concept used in developing a SMP to illustrate the role of shoreline management by assessing the effect of two contrasting management approaches - No active intervention and with present management - for all frontages and all epochs.
Bathymetry	Bed level topography of a water body (ie. the shape of the sea bed).
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Beach recycling	Artificial process of replenishing a beach by taking surplus sand from one part of the coastline to recharge depleted areas.

Term	Definition
Benefits (related to issue)	The service that a feature provides. In other words, why people value or use a feature. For example, a nature reserve, as well as helping to preserve biodiversity and meet national legislation, may also provide a recreation outlet much like a sports centre provides a recreation function.
Benefit cost ratio	This is the ratio between the value of the benefits that a section of defence protects and the cost of maintaining that defence over the period of the SMP. This is used to assess the economic viability of a proposed policy.
UK Biodiversity Action Plan	This sets out a programme for conserving the UK's biodiversity through targets for a range of specific habitats with the aim of reducing loss of biodiversity.
Brackish water	Freshwater mixed with seawater.
Breaker zone	Area in the sea where the waves break.
Catchment Flood Management Plan (CFMP)	<p>Catchment Flood Management Plans give an overview of the flood risk across river catchments, and recommend ways of managing those risks now and over the next 50-100 years.</p> <p>CFMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea, (sea flooding), which is covered in Shoreline Management Plans.</p>
Chart datum	Reference water level for navigation, generally a low tidal level.
Climate change	Long-term change in the patterns of average weather. Its relevance to shoreline management concerns its effect on sea levels, current patterns and storminess.
Coastal squeeze	The reduction in habitat area that can arise if the natural landward migration of a habitat due to sea level rise is prevented by the fixing of the high water mark, for example a sea wall.
Condition grade	Indicator based on visual inspection of flood defence condition ranging from condition grade 1 (very good) to 5 (very poor).
Conservation area	Local Authorities have the power to designate any area of 'special architectural or historic interest' whose character or appearance is worth protecting or enhancing. The 'specialness' is judged against local and regional criteria, rather than national importance. The special character of an area comes from the quality of the buildings, the historic layout of roads, paths and boundaries, characteristic building and paving materials, a particular 'mix' of building uses, public and private spaces and trees and street furniture, which contribute to particular views.

Term	Definition
Department for Food, Environment and Rural Affairs (Defra)	Government department responsible for flood management policy in England and Wales. Incorporates the former Ministry of Agriculture, Fisheries and Food.
Defra procedural guidance	Guidance produced by Defra to provide a nationally consistent structure for producing future generation Shoreline Management Plans.
Downdrift	In the direction of longshore movement of beach materials.
Ebb tide	The falling tide, part of the tidal cycle between high water and the next low water.
Ecosystem	Organisation of the biological community and the physical environment in a specific geographical area.
Enhance	The value of a feature increases.
Envelope of change	Highlights the full range of possible futures by defining two extreme ends of the scale
Environmental impact assessment	Detailed studies that predict the effects of a development project on the environment. They also provide plans for mitigating any significant adverse effects.
Epoch	A period of time. For SMPs three epochs are defined: <ul style="list-style-type: none"> • Epoch 1: present day to 2025 • Epoch 2: 2025 to 2055 • Epoch 3: 2055 to 2105
Erosional	A feature or system that has a tendency to decrease in size (either in a horizontal or vertical direction) as a result of material being removed from the feature / system. Removal of material can happen by weathering, solution, corrosion or transportation. In the case of saltmarshes and mudflats the main process is transportation.
EU Bathing Water directive	The aim of this directive is to protect public health and the environment from faecal pollution at bathing waters. It sets a number of microbiological and physio-chemical standards that bathing waters must either comply with ('mandatory' standards) or endeavour to meet ('guideline' standards).
EU Habitats directive	European legislation on the conservation of habitats.
European Annex I priority habitats	Annex I of the European Habitats directive defines certain habitats as being 'priority' because they are considered to be particularly vulnerable. Examples in The Wash SMP area include sandbanks that are slightly covered by sea water all the time, mudflats and sandflats not covered by seawater at low tide, a large shallow inlet and coastal lagoons.

Term	Definition
Feature	Something tangible that provides a service to society in one form or another or, more simply, benefits certain aspects of society by its very existence. Usually this will be in a specific place and relevant to the SMP.
Flood tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks.
Gabion	A cage filled with rock used to stabilise the shoreline against erosion.
Geomorphology / Morphology	The branch of physical geography / geology that deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water etc.
Groyne	Shore protection structure built perpendicular to the shore and designed to trap sediment.
Heritage assets	Property, plant and equipment of historical, cultural, artistic, or educational significance.
Heritage coast	A non-statutory designation by Natural England for coasts of scenic quality, their largely undeveloped nature and their special wildlife and historic interest. Local authorities assist with the management of heritage coasts, often with heritage coast officers.
Hinterland	Generally, area landward of the shoreline. For The Wash SMP this term is used to identify the area landward of the established settlements.
Historic environment	All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed flora.
Historic Environment Record	Formerly Sites and Monuments Register (SMR). This holds records of historical and archaeological structures, features and finds, as well as buildings and landscapes of historical or architectural interest within a given county or unitary authority area.
Indicators	Used to support the appraisal of policies against criteria.
Integrated	An approach that tries to take all issues and interests into account. In taking this approach, managing one issue adds value to the way another is dealt with.
Intent of management	A vision for the future of shoreline management along a certain frontage for all epochs. This vision is then translated to specific policies for the purpose of management.
Intertidal zone	Also known as the foreshore or littoral zone. The area that is exposed at low water and underwater at high tide.

Term	Definition
Land use adaptation	As with 'adaptation', but refers specifically to the process of changing how a defined area of land is used. The principles listed above for 'adaptation' still need to be recognised in the case of land use adaptation.
Listed building	A building or other structure officially designated as being of special architectural, historical or cultural significance.
Local Development Framework	A collection of local development documents that outlines how a local authority will manage planning in their area. All local authorities in England are required to produce a Local Development Framework under the Planning and Compulsory Purchase Act 2004.
Local Nature Reserves	A statutory designation for sites established by local authorities in consultation with Natural England. These sites are generally of local significance and also provide important opportunities for public enjoyment, recreation and interpretation.
Longshore movement / drift	The transport of beach material along the coast.
Maintain	That the value of a feature is not allowed to deteriorate.
Mean sea level	Average height of the sea surface over a 19-year period.
Mean high water	The average of all high waters observed over a sufficiently long period.
Mean low water	The average of all low waters observed over a sufficiently long period.
Mitigation	Practical measures taken to offset the impact of a policy on physical assets. The term mitigation has a specific meaning for particular types of physical asset: <ul style="list-style-type: none"> • For wildlife, mitigation may be any process or activity designed to avoid, reduce or remedy adverse environmental impacts of the plan; • For the historic environment, mitigation may be 'preservation by investigation' for archaeological features, or 'preservation by recording' followed by abandonment, demolition or re-location for listed buildings. There is no effective mitigation for the loss of historic landscapes.
Mudflat	Low-lying muddy land that is covered at high tide and exposed at low tide.
Natura 2000	An ecological network of protected areas in the EU Habitats Directive.
National Flood and Coastal Defence Database	National database for managing flood risk management asset data.

Term	Definition
National property dataset	Computerised information on the location and type of properties in England and Wales. This includes the value of properties based on 2005 values.
National Nature Reserves	A statutory designation by Natural England. These represent some of the most important natural and semi-natural ecosystems in Great Britain and are managed to protect the conservation value of the habitats that occur on these sites.
No-regret policies	Policies that do not have irreversible negative implications. In the case of The Wash SMP this means acknowledging and dealing with uncertain future developments by setting out a clear programme of monitoring, study and collaboration to support long-term decisions.
Objective	A desired state to be achieved in the future. An objective is set, through consultation with key parties, to encourage the resolution of an issue or range of issues.
Offshore zone	Extends from the low water mark to a water depth of about 15 metres (49 feet) and is permanently covered with water.
Ordnance datum	Elevation used on Ordnance Survey maps for deriving height. In the UK this is mean sea level in Newlyn, Cornwall measured between 1915 and 1921.
Playing field	Range of realistic shoreline management policies used in developing SMP policies.
Policy	In this context, "policy" refers to the generic shoreline management options (No active intervention; hold the existing line of defence; Managed realignment and advance the existing line of defence).
Policy development zone (PDZ)	A length of coastline defined to assess all issues and interactions to examine and develop management scenarios. These zones are only used to develop policy.
Policy package / scenario	A combination of policies selected against the various feature / benefit objectives for the whole SMP frontage.
Policy Unit	Length of shoreline for which one shoreline management policy applies.
Present value (PV)	The value on a given date of a future payment or series of future payments, discounted to reflect the time value of money and other factors such as investment risk. Present values are used to provide a means to compare cash flows at different times on a meaningful "like to like" basis. For this SMP the discount factors used are the latest provided by Defra for assessing schemes, that is 3.5 per cent for years 0-30, 3.0 per cent for years 31-75 and 2.5 per cent thereafter.

Term	Definition
Principle	High-level statement developed as part of the Shoreline Management Plan (on an appropriate geographic scale) that governs shoreline management, based on the key values and on local and national ambitions. The principles were agreed by partner authorities.
Prograding	When the shoreline is developing and building seaward by accumulation or deposition.
Ramsar site	Designated under the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971. The objective of this designation is to prevent the progressive encroachment into, and the loss of, wetlands.
Rapid Coastal Zone Assessment	Survey of the historic assets on the coast that were started by English Heritage to improve knowledge and understanding.
Registered parks and gardens	Parks and gardens registered for their historic value so they are considered in the planning process. Local planning authorities must consult English Heritage where planning applications may affect these sites.
Residential density	The number of people living in a residential area compared with the total area of residential land.
Residual life	Period of time until a defence has deteriorated to a state in which it no longer performs its function.
Rollback	The process by which assets physically move further inland away from the threat of coastal erosion.
Scheduled monument	A statutory designation under the Ancient Monuments and Archaeological Areas Act 1979. This act, building on legislation dating back to 1882, provides for nationally-important archaeological sites to be statutorily protected as scheduled monuments.
Setback	Prescribed distance landward of a coastal feature (for example the line of existing defences).
Shellfish Waters directive	Aims to protect or improve shellfish waters to support shellfish life and growth. It sets physical, chemical and microbiological water quality requirements that designated shellfish waters must either comply with ('mandatory' standards) or endeavour to meet ('guideline' standards).
Shoreline Management Plan	A non-statutory plan that provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner.

Term	Definition
Special Area of Conservation (SAC)	This designation aims to protect habitats or species of European importance and can include Marine Areas. SACs are designated under the EU Habitats directive (92/43/EEC) and will form part of the Natura 2000 site network. All SACs are also protected as SSSIs, except those in the marine environment below mean low water (MLW). By exception, the whole of The Wash SAC is also a SSSI.
Special Protection Area (SPA)	A statutory designation for internationally important bird species set up to establish a network of protected areas for birds. SPAs are designated under the EU Birds directive (79/409/EEC).
Special Site of Specific Scientific Interest (SSSI)	A statutory designation under the Wildlife and Countryside Act 1981. Notified by Natural England, representing some of the best examples of Britain's natural features including flora, fauna, and geology.
Storm surge	A rise in the sea surface on an open coast resulting from a storm.
Strategic Environmental Assessment (SEA)	A Strategic Environmental Assessment is a process, related to the European Union Directive 2001/42/EC, to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision-makers, monitored and that opportunities for public involvement are provided.
Sub-littoral	The area of the seas between the intertidal zone and the edge of the continental shelf.
Sustain	Refers to some function of a feature. A feature may change, but the function is not allowed to fail.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism (or tidal diamond)	The volume of water within an estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Tidal flood risk	The risk of flooding associated with the normal and extreme tidal cycles. Flood risk is measured as the probability of flooding (that is, at location X there is a 1 in 100, or one per cent, chance of flooding in any given year) multiplied by the impact or consequences that will result if the flood occurs.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Tumulus	A mound of earth and stones raised over a grave or graves that are of historic value.

Term	Definition
Water Framework Directive	A European directive aimed at the management of water bodies and their condition.
Water table	The upper surface of groundwater. Below this level, the soil is saturated with water.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

List of abbreviations and acronyms

Organisations directly involved in SMP	
AW	Anglian Water
BCKL&WN	Borough Council of King's Lynn & West Norfolk
EA	Environment Agency
EH	English Heritage
NCC	Norfolk County Council
NE	Natural England
NNDC	North Norfolk District Council
RFDC	Regional Flood Defence Committee
RSPB	Royal Society for the Protection of Birds
External / other organisations	
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CLG	Communities & Local Government
Defra	Department for Environment, Food and Agriculture
EACG	East Anglia Coastal Group (formerly ACAG - Anglian Coastal Authorities Group)
EERA	East of England Regional Assembly
EU	European Union
IDB	Internal Drainage Board
OS	Ordnance Survey
QRG	Quality Review Group
SMP Groups (Consultation)	
CSG	Client Steering Group
EMF	Elected Members Forum
KSG	Key Stakeholder Group
Plans/Strategies/Studies & Assessments	
AA	Appropriate Assessment
CFMP	Catchment Flood Management Plan
CHaMP	Coastal Habitat Management Plan
ICZM	Integrated Coastal Zone Management
LDF	Local Development Framework
MSfW	Making Space for Water
NI 188	National Indicator 188 (Climate change)
NI 189	National Indicator 189 (Flood risk)
PPG	Planning Policy Guidance
PPS25	Planning Policy Statement 25
RBMP	River Basin Management Plan
RCZAS	Rapid Coastal Zone Assessment Survey
RFRA	Regional Flood Risk Appraisal
RSS	Regional Spatial Strategy

SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SNS2	Southern North Sea Sediment Transport Study
UKCP	United Kingdom Climate Programme (formally UKCIP, United Kingdom Climate Impact Programme)
WFD	Water Framework Directive
WLMP	Water Level Management Plan
Special interest sites	
AONB	Area of Outstanding Natural Beauty
LNR	Local Nature Reserve
NNR	National Nature Reserve
SAC	Special Area of Conservation
SM	Scheduled Monument
SPA	Special Protection Area
SSSI	Site of Special Scientific interest
Technical terms	
AOD	Above Ordnance Datum
AtL	Advance the line
BAP	Biodiversity Action Plan
BCR / B - C Ratio	Benefit cost ratio
GIS	Geographical Information System
HTL	Hold the line
HWM	High water mark
IROPI	Imperative reasons of overriding public interest
LiDAR	Light detection and ranging
MR	Managed realignment
NAI	No active intervention
NFCDD	National flood and coastal defence database
NPD	National property dataset
OA	Operating authority
ODN	Ordnance datum Newlyn
OWF	Offshore wind farms
PDZ	Policy development zone
PV	Present value
SAR	Synthetic aperture radar
SOP	Standard of protection
WPM	With present management

1 Introduction

1.1 The Shoreline Management Plan

A Shoreline Management Plan (SMP) is a high-level policy document in which the organisations that manage the shoreline set out their long-term plan. The SMP aims to identify the best ways to manage flood and erosion risk to people and the developed, historic and natural environment and to identify opportunities where shoreline managers can work with others to make improvements.

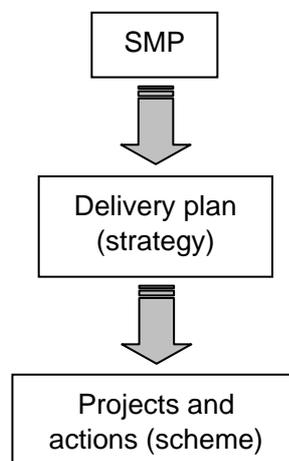
We developed a draft version of this SMP, which was out for Public Consultation from October 2009 until January 2010. The consultation generated a wide range of responses from the people and organisations with an interest in the shoreline of The Wash, which we have considered in developing this final version of the plan (see appendix B).

The SMP is an important part of the Department of Environment, Food and Rural Affairs (Defra) strategy for managing flooding and coastal erosion. This strategy has two key aims:

- to reduce the threat of flooding and erosion to people and their property
- to benefit the environment, society and the economy as far as possible, in line with the Government's 'sustainable development principles'. These are standards set by the UK Government, the Scottish Executive and Welsh Assembly Government for a policy to be sustainable.

As illustrated in figure 1.1, the SMP is the highest-level planning stage of Defra's strategy for flood and coastal defence. The SMP sets high level policies that are then implemented through delivery plans (such as strategies and asset management plans) and subsequently by projects and actions (such as schemes).

Figure 1.1 Defra's flood and coastal defence strategy hierarchy



Approximately 10 years ago, a first round of SMPs was completed for the entire length of the coastline of England and Wales. The first SMP for The Wash was completed in 1996. This revised SMP (SMP2) builds on the first round of plans because it is based on the additional information, studies and guidance developed since the first round SMP was published:

- The SMP is based on revised guidance that was published following Defra funded reviews (2001, 2003) of the strengths and weaknesses of various Plans;
- The SMP uses updated information collected from the Environment Agency's Shoreline Monitoring Programme and other published literature on climate change and sea level rise, including Futurecoast (Defra/ Halcrow 2002);
- It looks at the SMP boundaries following work undertaken as part of the Futurecoast study (Defra/ Halcrow 2002) and the English Nature internal report 'Shoreline Management Plans: advice on key boundary locations' (Halcrow 2001).

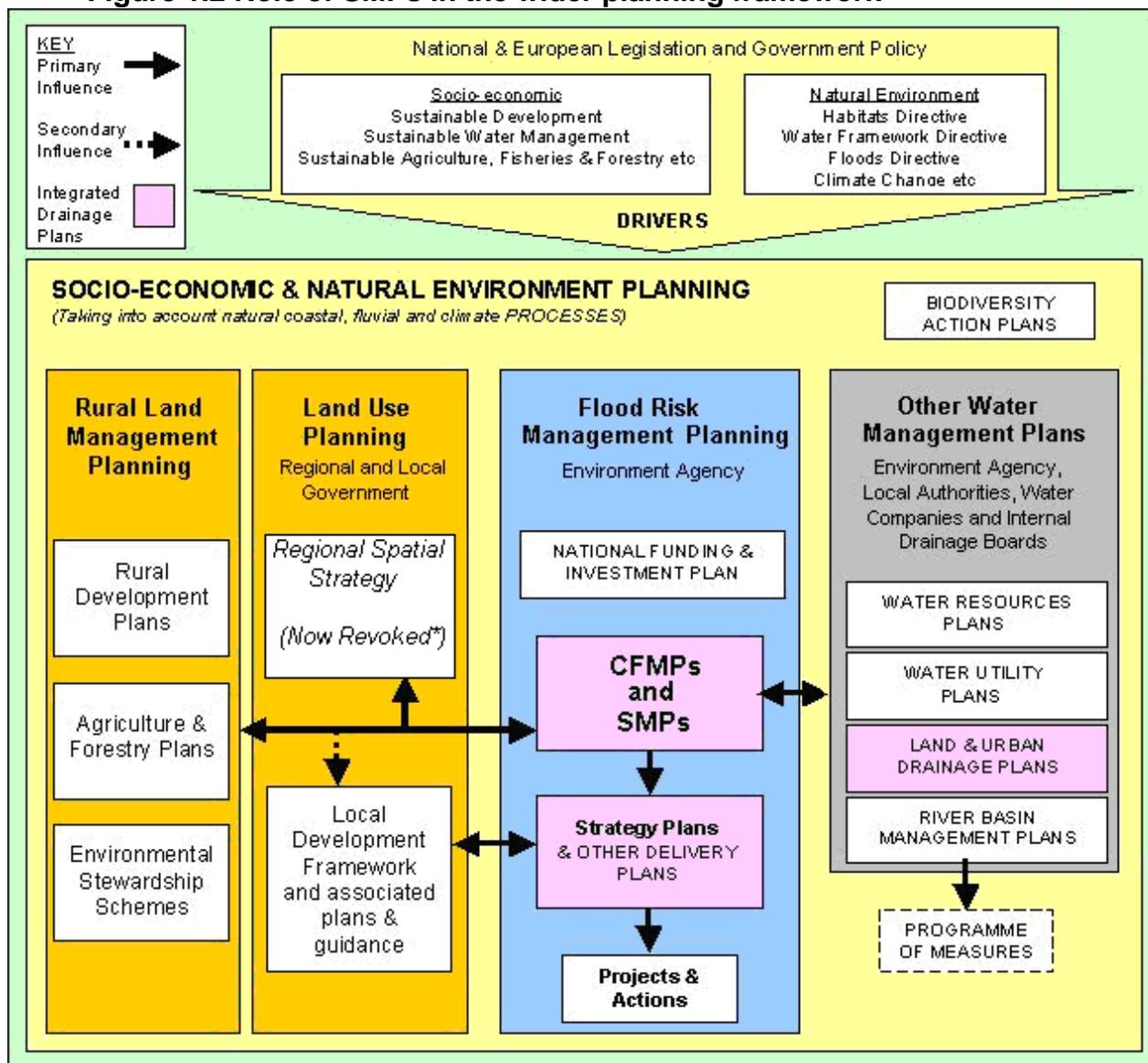
The main aim of the SMP is to develop an intent of management for the shoreline that supports the best possible and achievable balance of all the values and features that occur around the shoreline over the next 100 years. This intent of management, although mainly about managing the shoreline and its flood and erosion defences, also has to take into account the strong relationship with social, economic and environmental activities and values around the shoreline. SMP policies are not driven by the economics of flood and coastal erosion risk management. At the same time, the policies do have to be realistic and viable. This is especially relevant for the policies for the short term. Implementing SMP policies will require funding, which may come from national, local and / or third-party sources.



Typical defence configuration in the SMP area

The SMP does not make decisions about land use and environmental values. It does, however, set one of the parameters within which coastal land use and the coastal environment will function. The SMP has therefore been developed through a partnership approach between the Environment Agency, the local authorities, Natural England, English Heritage and other organisations that have an interest or responsibility in those fields. The SMP has been set up to take full account of the plans that these organisations make. Similarly, these organisations intend to take full account of the SMP in their decisions (such as the Local Development Framework for the local authorities' land use planning). Figure 1.2 illustrates the role of SMPs in land use planning. This concerns the Regional Spatial Strategy for the East Midlands (including the Coastal Study that has been carried out to inform it) and for the East of England (also known as the East of England Plan). The figure also illustrates the link with other water management plans such as the recently published River Basin Management Plan for Anglian region. Section 1.5 explains how the SMP takes account of other related plans and procedures. Note that on 6th July 2010, the Secretary of State revoked the East Midlands Regional Plan (RSS8), published in March 2009. In the absence of the RSS, Government advice is that local authorities should continue to work with the Environment Agency and across administrative boundaries, to plan development that addresses flooding and coastal change.

Figure 1.2 Role of SMPs in the wider planning framework



** While we developed this SMP within the context of the Regional Spatial Strategy, these have now been revoked. We recognise they are no longer valid and our direction and steer is replaced by local development plans.*

The intent of management is typically formulated in terms of the effect of shoreline management on land use and environment. It describes what we want to achieve through managing the shoreline. However, for use in coastal flood and erosion management, the intent of management has to be translated into one of four policies that describe the actual management of the shoreline itself:

- **Hold the line (HtL)** – this involves holding the defence on its existing alignment.
- **Advance the line (AtL)** – this involves building new defences seaward of the existing defence line. If relevant, use of this policy is limited to those stretches of coastline where significant land reclamation is considered.
- **Managed realignment (MR)** – this involves allowing the shoreline to move seaward or landward, with associated management to control to limit the effect on land use and environment. This can take various forms, depending on the intent of management to be achieved. All are characterised by managing change, not only technically (by breaching and building defences) but also to land use and environment (by facilitating or ensuring adaptation).
- **No active intervention (NAI)** – this involves no investment in coastal defences or operations.

It is important to note that the central decision in the SMP concerns the intent of management to be achieved. This constitutes the actual plan. The policies are only a means to implement the plan.

The first three policy options typically involve defences. The policies do not imply any particular standard of protection to be provided. They could be implemented by maintaining or changing the standard of protection. In most areas this is a decision that is taken beyond the scope of the SMP, in a strategy study or scheme. For most of The Wash SMP however, this is such a vital element of shoreline management that the partner authorities have agreed to make that decision within the SMP itself. This is discussed further in section 2.1.

The SMP needs to provide the intent of management and associated policy for each section of the shoreline, and for the short, medium and long term up to 2105. All SMPs use the following three time periods, referred to as epochs:

- epoch 1: now until 2025
- epoch 2: 2025 – 2055
- epoch 3: 2055 – 2105

For the later epochs, as uncertainty increases the intent of management and associated policies will be less fixed. The policies in this SMP are based on the current legal and policy framework, and our current technical understanding of present and future factors affecting coastal management. Shoreline management planning is an on-going process: it is fully recognised that changes in legislation, Government policy, enhanced technical understanding and the results of environmental monitoring could influence the choice of policies and may be sufficient to require review of the Plan. SMPs are therefore reviewed as new information and knowledge becomes available. In principle, this review occurs every five to 10 years in a rolling programme.

1.2 Project area

The project area is the section of shoreline for which the SMP describes the plan and sets the policies. For The Wash SMP, this is the frontage from south of Gibraltar Point up to and including the cliffs at Old Hunstanton. The project area also includes the banks of the downstream end of four main rivers (Witham, Welland, Nene and Great Ouse) up to the point where shoreline processes are relevant. Chapter 2 provides a characterisation of the project area and explains how the character of the area has played a vital role in developing the plan.



River Steeping marks the northern boundary of The Wash SMP2 (Courtesy: WESG/Robert Platts)

The boundaries at Gibraltar Point and Old Hunstanton match the neighbouring SMPs (Flamborough Head to Gibraltar Point SMP and North Norfolk SMP). Note that these boundaries represent a change from the original SMP. This change was implemented as a result of the need to treat The Wash embayment as one complete 'system'. The boundaries in the rivers Witham, Welland, Nene and Great Ouse match the downstream boundaries of the respective Catchment Flood Management Plans (CFMPs).

Figure 1.3 Location of open coast and estuary boundaries (red line denotes SMP area)



The exact location of the two 'open coast policy boundaries' is (see figure 1.3):

- north-west boundary – southern point of Gibraltar Point, along the right-hand bank of the Steeping River. As a result, the Gibraltar Point spit system, which acts as a morphological break between the sandy beaches to the north and the salt marshes and mud flats of The Wash to the south, is covered as a whole in the neighbouring Flamborough Head to Gibraltar Point SMP. The policy for the adjoining frontage (Gibraltar Point to

Skegness) is to hold the line and sustain the current level of flood risk, with potential localised managed realignment in the long term.

- north-east boundary – north-eastern end of Hunstanton cliffs. This ensures that Hunstanton and Old Hunstanton, which both fall within the limits of The Wash system, are dealt with in the same SMP, while the dunes to the north are covered as a whole in the neighbouring North Norfolk SMP. The policy for the adjoining frontage (Old Hunstanton Dunes) is to maintain the flood defence function of the dunes, initially by holding the line, but aiming to move gradually to a situation where the dunes function more naturally while still providing flood defence.

The adjoining SMPs were developed in parallel and with close interaction to ensure that the policies are compatible. This is discussed further in the relevant policy statements in section 4.

The exact location of the four estuary policy boundaries is (see figure 1.3):

- River Witham – the outfall of Hobhole Drain on the left-hand bank - the small unnamed drain on the right hand bank, located slightly upstream.
- River Welland – the A17 road bridge (Fosdyke Bridge).
- River Nene – Guy's Head.
- River Great Ouse – opposite the outfall of the unnamed drain on the left-hand bank at the point where the Old West sea bank (secondary defence) joins the main river bank on the right-hand bank, about 400 metres south east of the outfall of the unnamed drain. This is near Vinegar Middle, downstream of King's Lynn.

CFMPs have provided policies for the management of flood risk from the rivers, including the impact that high tides can have on river flooding. All CFMPs within the Wash SMP project area are approved, The general CFMP policy options are as follows:

- P1 - No active intervention
- P2 - Reduce existing flood risk management actions, accepting increase of risk over time.
- P3 - Continue with existing or alternative actions to manage flood risk at the current level, accepting that flood risk will increase over time from this baseline
- P4 - Take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change)
- P5 - Take further action to reduce flood risk (now and/or in the future)

The CFMP policies covering the inland areas from Gibraltar Point to Wolferton Creek are all Policy Option 4: 'Take further action to sustain the current level of flood risk into the future (responding to the potential increase

in risk from urban development, land use change and climate change)'. For the area from Wolferton Creek to Hunstanton, the policy is 'Policy Option 2'; the area is at low to moderate risk of river flooding which means that it is generally possible to reduce existing flood risk management actions. The SMP has taken this into account in developing the shoreline management policies.

A much wider area has been taken into account in developing the plan. This study area includes everything that can influence shoreline management and everything that can be influenced by it. The potential changing management of adjacent coastlines, as a result of the neighbouring SMP2s, has been taken into account within policy development. This study area covers much of the North Sea, the rivers up to at least their tidal limit, the whole area within the tidal flood zone and, to some extent, also the hinterland and further afield that has links to all the features in and around The Wash.



End of cliffs and start of dunes marks the north-eastern boundary of The Wash SMP

1.3 The plan development process

1.3.1 Organisations involved

The SMP has been developed through a partnership approach between all relevant authorities: the authorities that manage the shoreline, the planning authorities, the statutory stakeholders and other organisations that have a relevant interest or responsibility. These organisations have been involved through both officers and elected members.

The SMP is mainly the long-term plan of the authorities that manage the shoreline. For The Wash SMP this concerns:

- The Environment Agency (who manage most of the flood defences from Gibraltar Point all the way to Hunstanton);
- King's Lynn and West Norfolk Borough Council (who manage the high ground shoreline in Hunstanton).

Interaction between the SMP and land use planning is essential, so all planning authorities have been involved as full partners and were represented on both the Client Steering Group and Elected Members Forum by their planners. This involves the following four local authorities and two county councils:

- East Lindsey District Council;
- Boston Borough Council;
- South Holland District Council;
- Borough Council of King's Lynn and West Norfolk (in addition to their role as a shoreline management authority for part of their coastline);
- Lincolnshire County Council;
- Norfolk County Council.

The statutory stakeholders for the Strategic Environmental Assessment (see section 1.5) are:

- Natural England;
- English Heritage.

Of the other organisations that have an interest or responsibility in shoreline management around The Wash, the following five have been directly involved as partner organisations:

- Water Management Alliance (representing the King's Lynn and South Holland Internal Drainage Boards);
- National Farmers' Union (representing a large number of landowners);
- Royal Society for the Protection of Birds (landowner and special interest group);
- Wash Estuary Strategy Group and The Wash and North Norfolk Coast European Marine Site (two partnerships representing a wide range of stakeholders and organisations, some of which are also represented in their own right).

1.3.2 Stakeholder involvement

Appendix B contains a detailed account of the way in which we have involved stakeholders in developing The Wash SMP. The process of developing this SMP has been led by the organisations listed above (the Client Steering Group). Also, we have involved members from the local authorities, Lincolnshire County Council, Norfolk County Council and the Environment Agency's Regional Flood Defence Committee in the Elected Members' Forum. These representatives have scrutinised the SMP process from the start, and have provided a way for these authorities to influence the plan.

1.3.3 Public consultation

The Wash SMP was out for formal public consultation from 12 October 2009 until 15 January 2010. We produced a non – technical summary document so that everyone with an interest in the plan could easily see which policies we were proposing for each part of The Wash coast. The summary document included a CD containing the full draft SMP and all appendices. Over two hundred (200) copies of these were sent out to various partners and to consultees who had expressed an interest in The Wash SMP.

Copies of the SMP main document, non – technical summary and fact sheets were published and made available for viewing at the offices of Norfolk County Council, Borough Council of Kings Lynn and West Norfolk, Lincolnshire County Council, Boston Borough Council, South Holland District Council and East Lindsey District Council. Copies could also be viewed in the libraries in The Wash area, as well as the Hunstanton Library, Kings Lynn Library, Boston Library, Spalding Library and Wainfleet Library.

Both the summary document and the full draft SMP and appendices were also available on the Environment Agency website along with an electronic feedback form and a generic email address for the project.

A number of public drop-in sessions were arranged during the consultation period for the general public to learn more about the draft Wash SMP. A selection of The Wash SMP partner organisations had representatives available at these sessions to advice and answer queries. The full details of the consultation activities appear in appendix B.

Please find below the dates, venues and time of the drop – in events.

Tuesday 27 October, 2009

King's Lynn, Borough Council Offices, 10-3pm

Wednesday 28 October, 2009

Hunstanton, Town Hall, 1-7pm

Wednesday 4 November, 2009

Boston, Assembly Rooms, 10-3pm

Friday 6 November, 2009

Long Sutton, Market House, 1-7pm

Monday 9 November, 2009

Friskney, Village Hall, 12-6pm

Tuesday 10 November, 2009

Spalding, South Holland Centre, 10-3pm

Wednesday 11 November, 2009
Old Leake, Community Centre, 1-7pm

Friday 20 November 2009
Wainfleet, Coronation Hall, 1pm-7pm



Stakeholder Consultation Event, Hunstanton. Wednesday 28 October, 2009.

Approximately 350 people attended the drop – in sessions, with an average of 50 people attending per session. We received about 45 formal responses through the public consultation. Appendix B of this document contains a summary of these comments and how we have responded to them.

1.3.4 Overview of SMP development process

The development of SMPs follows the principles and processes set out in the Shoreline Management Plan Guidance that was issued by Defra in March 2006. The SMP Guidance identifies six stages. These stages and the period of completion are outlined below.



The publication of this Shoreline Management Plan marks the end of stage 5, after which the plan will be disseminated by the partner organisations to all stakeholders. Appendix A contains more detailed information on the development process thus far (Stages 1, 2 and 3).

1.4 Principles for shoreline management of The Wash

Text box 1.1 Principles

The development of the SMP has been based on a set of principles that was agreed among all organisations involved in the process. Some of these principles can be, by their nature, contradictory. This reality is one of the main challenges of shoreline management. It is unlikely, or even impossible, to achieve complete fulfilment of all these principles. So instead, the SMP aims to provide the best achievable balance between the principles on the short, medium and long term. As a whole, this set of principles represents the balance of values to which the SMP aspires. The order of the principles does not indicate the order of importance.

1. To balance flood and erosion risk management with the value of the features that it protects
2. To ensure that shoreline management takes into account longer term adaptation options
3. To develop policies for flood and erosion risk management that will enable appropriate future development
4. To ensure that localised decisions do not affect the natural balance of the coastline and shoreline management elsewhere
5. To ensure that shoreline management supports the continuation of sustainable patterns of development and considers possible effects on communities and their welfare
6. To ensure that shoreline management informs the land use planning system
7. To ensure that shoreline management supports the sustainable provision of the social and economic values of the area to the wider society
8. To ensure that shoreline management supports conservation and enhancement of biodiversity
9. To ensure that shoreline management takes into consideration the management objectives of environmentally designated sites and species
10. To ensure that shoreline management recognises the character of the coastal landscape
11. To ensure that shoreline management has regard to the historic environment

These principles have been used as a framework for developing policy appraisal objectives, to enable location-specific testing of policy options. These are illustrated in text box 2.2 (page 67) and listed fully in appendix E, section E2.4.

1.5 Compliance with procedures and related plans

This SMP takes full account of the requirements from a number of important related fields. It has been developed through a parallel and integrated process with a Strategic Environmental Assessment (SEA, related to the associated EU Directive), and an Appropriate Assessment (AA, related to the EU's Habitats Directive), that are provided as stand-alone documents. The SEA is provided as appendix L and the AA is provided as appendix M. Furthermore, the SMP's inclusion of general sustainability criteria has been demonstrated through a signposting exercise based on the Sustainability Appraisal (SA) process. This is included in appendix J. Finally, the level of compliance with the EU's Water Framework Directive is assessed in appendix K.

The SMP has also been developed in parallel with the Local Development Frameworks and Regional Spatial Strategies. There have been particular links with the Coastal Study that has been carried out to inform the East Midlands Regional Spatial Strategy about the constraints and opportunities for land use in the coastal area of Lincolnshire. The Strategic Flood Risk Assessments (SFRAs) that the Local Planning Authorities carry out to support development planning have informed the SMP process.

It is also useful to highlight two related policy documents that deal with a number of key coastal issues relevant to The Wash SMP area. These policy documents have both been out for consultation in 2009 and are as follows:

- Communities and Local Government - Development and Coastal Change Policy, published 9th March 2010
www.communities.gov.uk/publications/planningandbuilding/coastalchange
This is relevant because local planning authorities will use it to make decisions about land use planning in the coastal zone.
- Department for Environment, Food and Rural Affairs - Consultation on Coastal Change Policy
<http://www.defra.gov.uk/corporate/consult/coastal-change/index.htm>
Following on from the Coastal Change Policy consultation, 'Pathfinder' funding has been awarded to Lincolnshire County Council and to King's Lynn and West Norfolk Borough Council (via North Norfolk District Council), to be used for exploring new approaches to coastal adaptation.

1.6 Structure of the Shoreline Management Plan

The Shoreline Management Plan is divided into a number of components. There is the main SMP document (this document), which includes a set of accompanying appendices. Also, there is a separate non-technical summary, a stand-alone Appropriate Assessment (AA) and a stand-alone Strategic Environmental Assessment (SEA).

The main SMP document is aimed at a wide audience, typically an elected member of a relevant authority or interested member of the general public. The document is intended to be as concise as possible, without excluding important details. The aim of the main document is to justify the plan and policies and to identify what they mean. Because of this, the information in the main document is only about the final plan as agreed and confirmed. Information about alternative policies that were considered during the SMP process is included in appendices E and F.

The structure of this document is as follows:

- Chapter 2 presents a summary of the technical background of the SMP and refers to a set of technical appendices for more details;
- Chapter 3 provides a high-level description of the plan and policies, the overall reasoning behind it and its implications;
- Chapter 4 provides more details on the plan in the form of maps and tables;
- Chapter 5 contains the action plan - an overview of the specific activities that the partner organisations have agreed for implementing the plan and policies.

The non-technical summary is a concise and more accessible version of the main document. For this reason, it only contains information that is included in the main document itself and not in any of the appendices. This non-technical summary is aimed at a wider audience than the main document and is intended to be understood by the general public.

2 Basis for plan development

This section describes the background of the Shoreline Management Plan. Management of the shoreline combines technical elements with 'softer' elements. The SMP aims to use coastal processes and defences to achieve the best possible balance between all relevant uses of the land and the environment. This section starts by describing both the technical side (in section 2.1) and then describes land use and the environment around The Wash (in section 2.2).

2.1 Coastal processes and coastal defences

2.1.1 Introduction

The Wash is a large (around 615 km² or 15 by 15 miles), relatively low-energy coastal inlet (also referred to as an embayment), open to the North Sea, in which tides are the main (but not the only) factor in controlling sedimentary processes.

Four tidal rivers, namely the Witham, Welland, Nene and Great Ouse, drain into the embayment. At the mouth of each river there are a number of wall structures that maintain the drainage function and navigability of the river outfalls. The outfalls of the rivers Witham and Welland are combined and trained by walls and so flow into The Wash as one combined river.

Tidal flood embankments separate The Wash from the land-claimed coastal plain of the Fenland. Seaward of these embankments is a large expanse that is exposed at low tide and submerged at high tide (known as the intertidal zone). This consists of a mosaic of sand banks and low water channels. The intertidal zone is divided into salt marsh closest to the defences and sand and mud flats towards the low water mark. There is a beach ridge between Wolferton Creek and Hunstanton and there are sea cliffs at Hunstanton.

A full assessment of the coastal processes in The Wash area is included as appendix C and a brief summary is provided in the following sections.



Overview of The Wash embayment

2.1.2 Key processes

There are a number of key physical processes occurring in The Wash and an understanding of these processes is necessary for developing this plan.

The edge of The Wash is characterised by salt marsh and mud flat. This relatively high foreshore plays an essential role as a natural flood defence, by absorbing incoming wave energy and therefore reducing wave attack on the earth embankments. The salt marsh and mud flat also provide a habitat for many plants and animals. The Wash contains a large share of all intertidal habitat in the UK (see section 2.2 for more details).

The development of the intertidal area in The Wash is governed by a wide range of factors on a number of different spatial and temporal scales. At the largest scale, historic post-glacial sea level rise caused accretion in embayments such as The Wash. Now the large-scale factors are dominated by the abundant availability of sea bed sediments, which are reworked by tidal processes and are transported into The Wash. Largely because of this, the intertidal area in The Wash has generally been accreting for the last 2,000 years. This overall accretional trend has been influenced by a wide range of other factors. On the scale of The Wash as a whole, the lay-out of the channels, the orientation of the shoreline in relation to predominant

winds, the occurrence of storm events and the influence of centuries of human intervention, including reclamation, cause a variability at the medium scale (tens of kilometres).

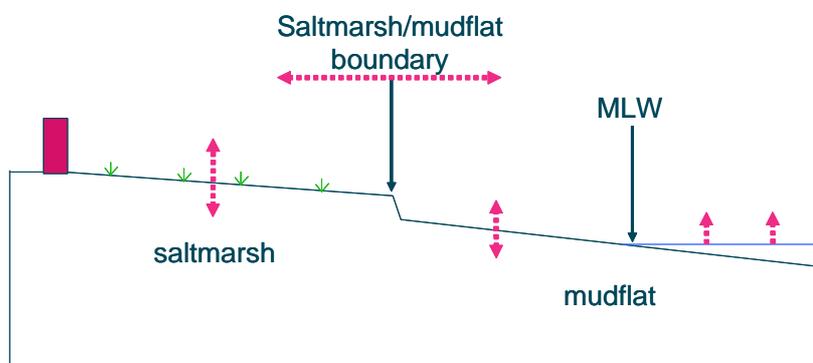
As well as these large-scale processes, there is a range of factors that determine smaller-scale developments. At a local level, salt marshes develop around the upper and middle tidal levels where there is a low-energy stable environment. The salt marshes support a range of salt-loving vegetation and generally grade towards mud and sand flats at their seaward edge. The salt marsh vegetation is important in trapping sediment and building up the marsh surface. In The Wash, the boundary between the salt marsh and mud flat is distinctive and takes on a cliff-like appearance.

The intertidal zone as a whole responds to changes in external factors in a number of ways:

- During times of sufficient sediment supply and relatively low rates of sea level change (either rise or fall) both the salt marsh and mud flat can accrete vertically (the salt marsh and mud flat surface build up). At the same time vegetation can colonise at the landward edge of the mud flat. This has the effect of moving the salt marsh/ mud flat boundary in a seaward direction, therefore resulting in an overall increase in both salt marsh and mud flat.
- During times of high rates of sea level rise and adverse climatic conditions, erosion of the mud flat and salt marsh is likely. Vertical erosion of the mud flat surface increases wave attack on the salt marsh/ mud flat boundary (causing landward movement) and the salt marsh surface can also erode. This results in an overall loss of salt marsh and mud flat area.

Figure 2.1 illustrates the potential movement of salt marsh and mud flat.

Figure 2.1 Intertidal zone development





Characteristic view of the intertidal area (Courtesy: WESG/ Simon Cooter)

Environment Agency monitoring (see section 2.1.4) has shown that the recent trends for The Wash are accretional across the salt marsh, resulting in an overall increase in salt marsh area. Across the mud flat there has been a mix of trends with most of frontages experiencing accretion. For only half of the total coastline the rates of mud flat accretion have been greater than the rate of sea level rise, leading to an overall increase in mud flat area. For the other frontages the accretion rates have not been greater than the rates of sea level rise, and there has been an overall loss of mud flat area.

A stretch of The Wash SMP area; around Heacham, is also characterised by a managed shingle ridge. Shingle ridges usually develop when a storm pushes material high enough onto the beach so it is not affected by normal waves and tides. In this situation the shingle ridge can stabilise and become colonised by vegetation. The existing management regime of the shingle ridge keeps it in its current location; if allowed to develop naturally, the shingle ridge would probably have a natural tendency to 'roll back' in a landward direction due to storm wave and wind action. This process would be further enhanced by sea level rise as wave heights increase.



Managed shingle ridge and beach, Snettisham

2.1.3 Geological development

This Wash-Fenland basin was created during the late Cretaceous and Tertiary period (about 99.6 to 5.3 million years ago) as part of a clay vale stretching from Humberside to Cambridgeshire. This was caused by gradual erosion of the softer mudrocks while the harder more resistant chalk bed, laid down in the early Cretaceous (145.5 to 99.6 million years ago), remained.

The modern landscape of The Wash has been carved out by the repeated advance and retreat of glaciers and ice sheets (known as ice ages) that have occurred during the last two million years (Pleistocene). During the Anglian glaciation, the first glacial period to significantly shape The Wash landscape, ice originating in the North Sea widened and deepened the embayment and deposited till, sands and gravels over a wide area that included East Anglia and the Midlands. As the ice sheet withdrew, a drainage system became established that flowed into the newly-formed Wash-Fenland basin. A number of glacial periods followed the Anglian glacial. The most recent was the Devensian when the ice flowed south into the embayment. During this time the ice reached a line roughly located between Boston and Hunstanton. The evolution of the Devensian landscape caused a lowering of the Fenland surface independent of the rivers and the large quantities of gravel deposited in their vicinity, leaving the gravels isolated in the southern Fenlands as 'islands', such as at Chatteris and Ely.

In its natural state, typified by a period between 8,000 and 2,000 years ago, The Wash embayment was even greater than it is now and incorporated much of the modern Fenland. During this time it partly filled with sediment in

response to post-glacial sea level rise and local and regional marine and estuary processes. Rates of sea level rise were initially high, estimated at about 4.5 metres every 1,000 years (which, due to the flat terrain, means a loss of land of 30 - 60 metres a year horizontally). Around 6,000 years ago, this rate slowed to less than 1.3 metres (vertically) every 1,000 years. The combination of sediment infilling and a reduction in the rate of sea level rise led to a seaward movement of the shoreline (post-5,000 years before present), indicating accretion. Initially this accretion was local, but around 3,000 years before present it was occurring on an embayment-wide scale. After 3,000 years before present there was a second phase of landward shoreline movement which was caused by a lack of sediment supply relative to sea level rise. This led to tidal processes re-working previously-deposited sediment.

2.1.4 Recent development

More recently, shoreline movement has largely been dictated by human activity. From as early as the first or second centuries AD, land reclamation started with the building of the Car Dyke and Fen Causeway. From the Middle Saxon period (from around 650AD) there is evidence of renewed colonisation of the Fens. The earliest sea defence, the Sea Bank, was built around the Late Saxon period. By the Middle Ages the wetland resources of the Fens were widely used and were a centre of productivity for fishing, wildfowling, grazing, peat extraction and salt production.

The 13th century was a period of community-led large reclamations. Following this, a series of storm and flooding events then slowed the process of reclamation for several centuries with a battle between man, land and sea being continually fought.

In the mid-17th century, the most important phase of land claim in The Wash began and focused on the large western area of salt marsh. Since then, around 320 km² of The Wash has been turned into agricultural land, leading to a shoreline that is continually changing (Brew and Williams 2004). The last land claim in The Wash was in the early 1980s. Over recent decades planning policies have prevented further land claim.

There are a number of significant effects of this long history of land claim. There has been a net reduction in overall intertidal mud flat and sand flat area as the succession of salt marsh, mud flat and sand flat is compressed into a narrower zone. Also, the reclaimed land is no longer subject to deposition of marine sediments, whereas this process continues on the seaward side of the embankment. In combination with settlement of the soil caused by drainage, this leads to a situation where the land on the landward side of the embankment is often significantly lower lying than the intertidal area.

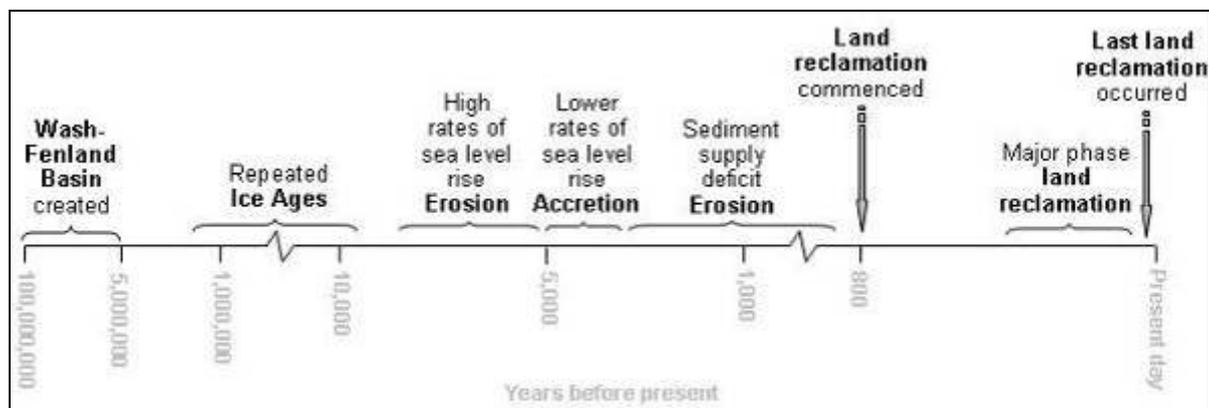
The overall development of The Wash is that, for at least the last 6,500 years, sedimentation has generally out-paced the rate of sea level rise. This has caused the salt marsh's seaward edge (salt marsh/ mud flat boundary) to advance seaward, leading to an overall increase in salt marsh area. Analysis of recent (1992 to 2006) Environment Agency beach profile monitoring data has shown that, in general, the salt marshes of The Wash area are still accreting horizontally, and therefore outpacing the rate of sea level rise. This had led to an overall increase of just over 1,000 hectares in total salt marsh area between 1992 and 2006 (figure 2.2). This increase occurs around the whole of The Wash, with the most significant increase on the south-western flank of The Wash, particularly between the rivers Welland and Nene. The analysis has shown that sediment is also still being deposited on both the salt marshes and mud flats, causing both to increase in height. This is particularly apparent on new salt marsh that formed in the past decade.

Figure 2.2 Salt marsh area accretion and erosion 1992 – 2006 (hatched area is 1992 and solid orange area is 2006)



Figure 2.3 provides a simple timeline of the development of The Wash as discussed above.

Figure 2.3 Timeline of geological and recent development, The Wash



2.1.5 Contemporary processes and geomorphology

As described in section 2.1.3, historically the ongoing sea level rise after the last ice age has caused a net transport of sediment on to the shore, leading to gradual infilling of The Wash embayment.

Today, The Wash's large tidal range is able to generate strong currents that are sufficient to move and transport sediment in most places. Also, wave action leads to local erosion and therefore starts sediment transport. As a result, The Wash as a whole acts as a sink for sediment transported along the coastlines of Lincolnshire and north Norfolk and for sediment carried in suspension in the North Sea. Sediment deposition is also continuing at a faster pace than sea levels are rising, and so the intertidal areas can continue to accrete.

Just outside the very north-western limit of the SMP study area is Gibraltar Point. This geographical landform (spit) has formed as a result of sediment accumulation at the point at which the coastline dramatically changes direction at the mouth of The Wash. The spit is fed from sediment transport that moves in a southward direction from the Lincolnshire coast and beyond, and also from the sand banks that lie just offshore of Skegness. This feature acts to constrain the north-western side of The Wash's mouth and provides some shelter against wave attack for the areas immediately in its lee. In the middle of The Wash there are a series of deep water channels, for example the Boston Deepes, that are scoured out by the tide as it rushes out of The Wash embayment. The strength of this flow is further increased by the volume of water discharged from the four main rivers. The outfall of these rivers into the embayment is characterised by classic delta formations. These tidal deltas and channels show periodic changes in layout, size and

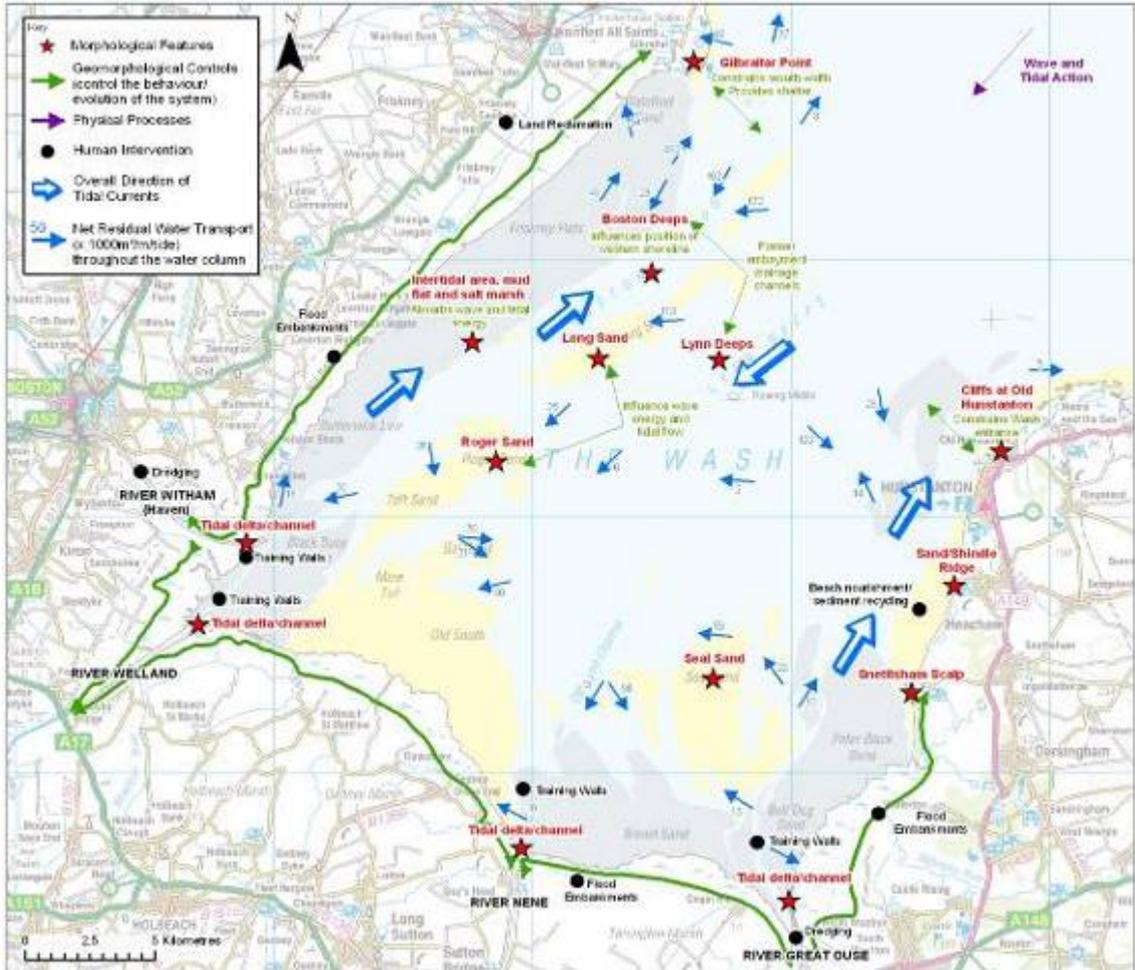
shape. This change is usually triggered by short-term storm events. Between the deep water channels there are a series of offshore sand banks. These offshore banks are generally parallel to the main direction of tidal flow and separate the flood and ebb dominant transport pathways. The deepwater channels form the boundary between these offshore banks and the intertidal sand and mud flats and salt marshes. The boundary between the salt marsh and mud / sand flat in The Wash is characterised by an obvious change in height and density and type of vegetation cover. These sand/ mud flats and salt marshes are extremely important in providing natural flood protection as they absorb incoming wave energy before it reaches the upper salt marsh and man-made defences.

The eastern face of the embayment is different, both in terms of coastal processes and shape. There are simple sea cliffs at Old Hunstanton, composed of weak rock (chalk and sandstone). The cliffs are undefended and are therefore experiencing erosion. This is dominated by toe erosion, with the major failure mechanism deemed to be stress induced failure as a result of deep undercutting. From Hunstanton to the south there are sandy beaches backed by a natural (although maintained) shingle ridge. These cliffs provide the constraint to the north-eastern side of The Wash's mouth as the Gibraltar Point spit does to the north-west. The sandy beaches are steeper to the south than to the north and turn into mud flat further seaward. The extent of these mud flats is constrained by the deepwater channels and offshore banks.

Human intervention has had a great effect on the contemporary development of The Wash. As discussed in section 2.1.4, extensive land claim has been the most important factor in The Wash's development as it has directly shaped the geography. Also, it has enhanced the ongoing large-scale natural process of accretion. Reclamation is typically followed by enhanced rates of accretion until the large-scale dynamic equilibrium intertidal width is restored. This is discussed further in appendix M; section M6.3.1. The rivers that flow into the embayment are also subject to human intervention, with their outfalls being trained and their channels being dredged to make sure their navigability is maintained. A history of beach and shingle ridge management along the eastern flank of The Wash has reduced the amount of overwashing of the ridge and has limited its ability to migrate landwards in response to sea level rise.

The key physical features, processes and controls, key linkages and effects of human intervention are illustrated in figure 2.4.

Figure 2.4 Key physical components



2.1.6 Coastal defences

Most of defences in The Wash are grassed earth embankments, more commonly known as sea banks. The flood defences provide protection to a significant area of low-lying high quality agricultural land. The focus of the SMP is on the primary (main) defences with a formal flood defence function. As mentioned, the large expanse of natural salt marsh and mud flat in front of the earth embankments absorbs wave attack and so helps to protect the low-lying area behind the earth embankments.

At a number of places behind these main, frontline defences the remnants of secondary and tertiary lines of defences exist in the form of old sea banks (see figure E3.5 in appendix E). These old banks provide evidence of the stages of land claim that have been carried out. Most have no formal flood defence function any more, although they would probably reduce the consequences if a major flood event did occur. The SMP process has identified the need to confirm the condition of these old defences, the role they could play in flood risk management and the responsibilities for managing them. This is included in the SMP's action plan. In addition to

these old sea banks shown in appendix E, there are also many additional old defences which do not have a residual defence function but do have historic value.

Although sea banks are characteristic of most of The Wash embayment, most of the south-eastern face is defended by frontline defence consisting of a natural (but maintained) shingle ridge with isolated sections of sea wall and revetment. These are backed by a secondary line in the form of an earth embankment. These defences protect low-lying land, but the protected area is much smaller than around the north-west and south-west faces of The Wash. The Hunstanton frontage is also different. It is not at risk of flooding beyond the promenade, but is protected against erosion by a combination of sea walls, promenades, wave return walls and beach control structures (timber and concrete groynes). The only entirely undefended length of The Wash SMP area is Hunstanton cliffs which are now allowed to erode naturally, although there is evidence that their base (toe) has been defended in the past.



Beach control structures, Hunstanton (Courtesy: WESG / Jo Halpin-Jones)

The condition of flood and coastal defences is regularly checked by those who manage them. Most of the defences along The Wash are assessed to be in 'good' or 'fair' condition, which is typical for defences of this type. The condition of each individual defence is an indicator of the time it would take for the defence to fail in the extreme scenario that the defence would cease

to be managed (a 'No active intervention' scenario). This information is needed to determine the effect that shoreline management has on the position and nature of the shoreline of The Wash, and the activities and values around it (elaborated in section 2.3). Table F2.2.7 in appendix F shows the results of this assessment. The overall conclusions are discussed below.

The primary defences between Gibraltar Point and the River Witham have residual lives of between 10 and 15 years (that is, if maintenance was halted on these defences now, in 2010, it is expected that they would gradually deteriorate and become redundant sometime between 2020 and 2025). Along the Gibraltar Point to River Witham frontage, the defences with the lowest residual life occur in the north-eastern half of the frontage, namely between Gibraltar Point and Leake Hurn's End.

Between the River Witham and the River Great Ouse, the defences are generally in a better condition and therefore have longer residual lives. Some defences along this stretch even have residual lives of between 30 and 45 years, meaning that if they did not receive any maintenance from today (2010), they would still continue to provide some protection up to 2055.

Between Wolferton Creek and the southern extent of Hunstanton town, the shingle ridge and beaches need continuous maintenance to keep performing their flood defence function. The shingle ridge is classed as a natural defence and therefore is assessed differently. Its standard depends very much on continued beach recycling and reprofiling of the shingle ridge. The Environment Agency and the local authority (King's Lynn and West Norfolk Borough Council) have put in place enhanced flood warning and evacuation procedures because of the large number of caravans and properties between the shingle ridge and the secondary flood bank.

The assessments of residual flood defence life assume that the current width of salt marsh stays the same. If, however, the area of salt marsh decreases substantially, the waves reaching the embankments would strongly increase. In this situation, the residual life of the defences as discussed above would be significantly reduced. If the standard of protection is maintained their height would typically have to be increased significantly.

Flood defences reduce the likelihood of flooding, but they cannot prevent flooding altogether. In the recent past there have been examples of storm events which have led to damage and breach of the defences in The Wash. The most significant event was on 31st January and 1st February 1953. This event was the greatest storm surge recorded for the North Sea, with the surge height reaching nearly 3 metres at King's Lynn. Coastal defences from Yorkshire down to the Thames were breached. The earth embankments around The Wash were overtopped and 15 people lost their lives in King's Lynn. A further 65 people died between Snettisham and south Hunstanton. This was the largest number of flood casualties at any one site in the United

Kingdom. Another event then occurred in 1978, which saw the highest ever recorded water levels in this location. The seawall breached at Heacham North Beach, and significant damage to property occurred, but fortunately no loss of life. A further event in 2001 caused severe erosion of the shingle ridge and damage to the defences, but again no loss of life.

2.1.7 Future external development

Climate change (natural and human) is causing sea levels to rise. This rate has been between one and two millimetres a year since 1900. Figure 2.5 provides an overview of recorded sea level changes since 1830 for four locations in the United Kingdom. This figure clearly shows that there has been an overall rise in sea levels for the whole coast of the United Kingdom since records began.

Figure 2.5 Recorded sea level rise (Proudman Oceanographic Laboratory)

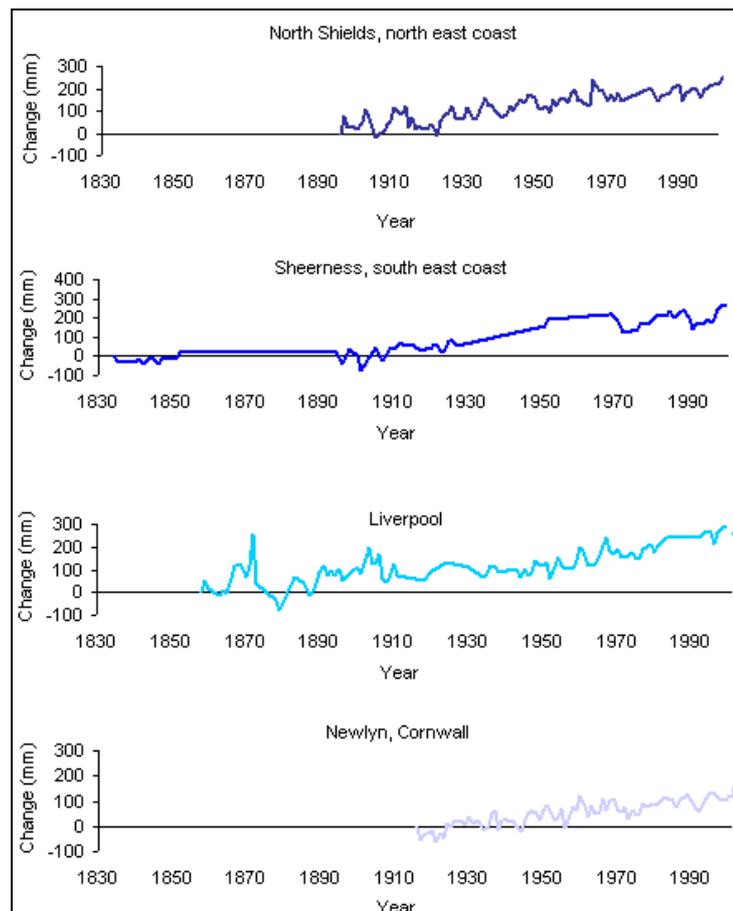
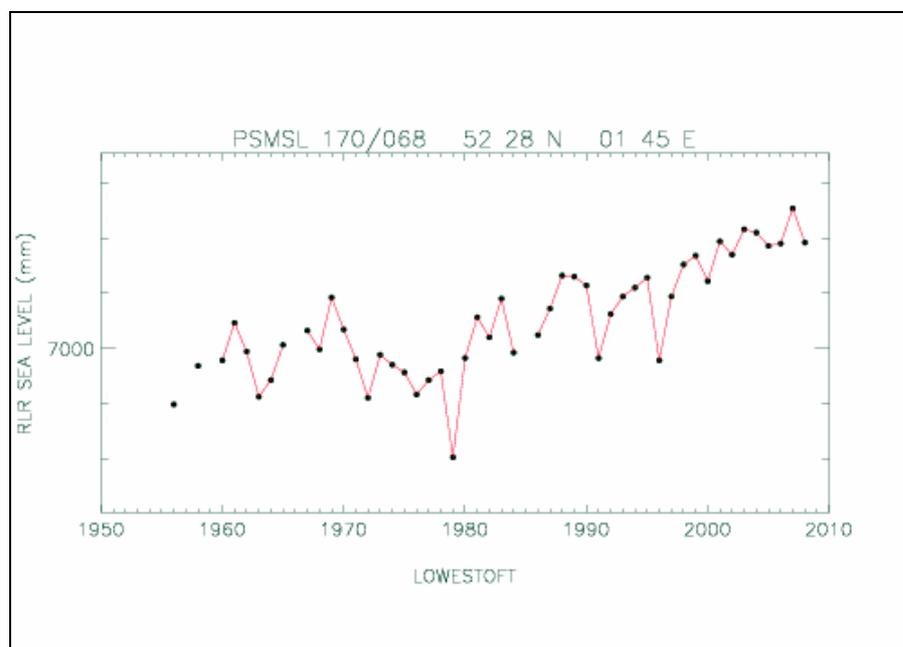


Figure 2.6 shows the same information for Lowestoft, which is closer to the SMP area. The record is shorter, but shows a similar trend. The recorded rise is approximately 100 mm in the last 50 years.

Figure 2.6: Recorded sea level rise at Lowestoft



However, there is a large uncertainty surrounding the future rate. One definite fact is that global temperatures are rising and this is leading to the thermal expansion of water and the melting of land ice. Combined, these two effects are causing global sea levels to rise. Rates of this sea level rise are uncertain, but it is essential that this SMP takes into account the possibility of increasing sea level, regardless of the cause. This is known as applying the precautionary principle. The Defra guidance (2006) provides values for sea level rise for the three epochs. These are the values that have been used in all SMPs in assessing future shoreline response and in the more quantitative assessments of intertidal habitat loss. Table 2.1 provides the Defra guidance values for the east of England, suggesting a total sea level rise of 1.1 metres by the end of epoch 3 (2105).

The UK Climate Impacts Programme published an update of its projections in 2009 (UKCP09). This emphasised the importance of the issue, and also highlighted the uncertainty about the actual rates by presenting a range of possible futures. The rates used in the SMPs fall within the range that UKCP09 predicts. In the SMP, we have assessed the impact of this uncertainty through sensitivity analysis; see appendix E (section E4.2.2).

Table 2.1 Defra (2006) sea level rise guidance for the east of England

Time period	Net sea level rise (mm a year)	Total sea level rise (mm)	Cumulative sea level rise (mm)
Epoch 1 2009 to 2025	4	64	64
Epoch 2 2025 to 2055	8.5	255	319
Epoch 3 2055 to 2085 2085 to 2105	12 15	360 450	679 1,129

As well as sea level rise, it is likely that climate change will bring about increased storminess. This could have an impact on the protection levels that defences provide and on the supply and behaviour of sediment in The Wash. There are currently no long-term data sets available to identify specific trends in the occurrence of storms, but the sensitivity of this plan to increased storminess has to be taken into account.

The key to taking into account the effects of sea level rise, climate change and the associated effects, and the large uncertainties associated with the sea level rise values, will be to establish no regret decisions for the shorter term, but at the same time emphasising the need to start preparing for change.

With the increasing drive for renewable energy, and the current building of large offshore wind farms, it is also important to consider the potential effect of the cables associated with these structures on the geomorphology and overall coastal functioning of The Wash embayment. It is likely that these cables will be buried under the sea and intertidal areas with at least two metres of cover, so the effects are likely to be only short-term and local. The installation of the cables is likely to cause disturbance during building, particularly to the intertidal area, and release suspended sediments into the water column. However, it is believed that this would not have a long-term effect on the physical functioning of The Wash system, so is not relevant to shoreline management at the level of the SMP.

While developing the SMP, there has been discussion about an extreme version of the SMP's Advance the line option. The partner organisations decided at the beginning of policy development and appraisal that such an option is not realistic for the following reasons: the impacts on The Wash would be massive, and the possible future need for good quality agricultural land is not sufficiently clear to act as a driver. However, there is the possibility that, in the medium and long term, the societal framework (for example environment, role of The Wash area in safeguarding food security for the UK, energy and public perception) could change to such an extent that an Advance the line option may become realistic. This needs to be

included in future reviews of the SMP. The partner organisations also noted the existence of a separate private 'idea' to construct a barrier at the mouth of The Wash. Due to the vague nature of this 'idea', it was decided that it would not feature in developing SMP policies.



Grade 1 agricultural land, Moulton (Courtesy: WESG/ Alan Lambert)

2.2 Land use and environment

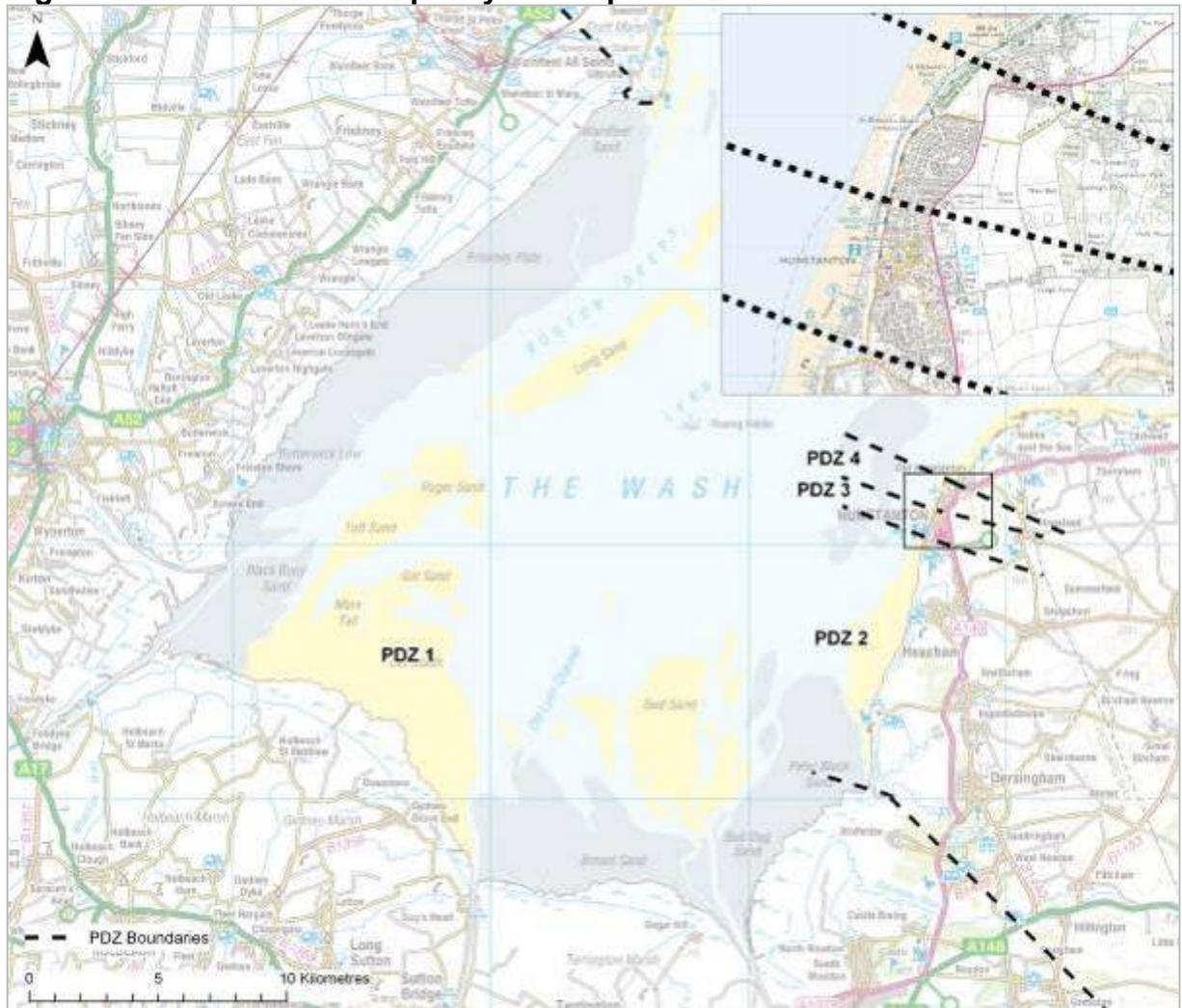
2.2.1 Introduction

This section aims to provide an overview of the land use and environment throughout the SMP area. It also discusses the potential future external developments, such as the potentially changing position of agriculture and squeeze of the intertidal area as a result of sea level rise.

Rather than discussing the entire SMP as one complete unit, this section divides the SMP area into four zones that are relatively uniform and self contained. This means that the SMP needs to develop its plan at the level of these zones (while taking into account any interactions between the zones). These four zones are called policy development zones (PDZs). For The Wash SMP, four PDZs have been identified, as listed below and shown in figure 2.7. The specific situation is very different in the four policy development zones and this will be reflected in this plan. These PDZs can be treated as policy units at the level of the SMP. The SMP will therefore describe the plan for shoreline management per PDZ. The text below, which discusses each PDZ, explains why each area is treated as one zone.

- PDZ1 – Gibraltar Point to Wolferton Creek
- PDZ2 – Wolferton Creek to south Hunstanton (up to the point where the high ground reaches the shoreline, roughly at the helter skelter located on the promenade)
- PDZ3 – Hunstanton town
- PDZ4 – Hunstanton cliffs (the undefended cliffs of Old Hunstanton)

Figure 2.7 The Wash SMP2 policy development zones



Within each PDZ, land use and environment are described for both the coastal strip and hinterland. The text is illustrated by a set of graphics; see figure 2.9 to figure 2.19. As can be seen by the text, the coast is a complex area that combines a range of different functions and values: physical, ecological, social and economical. The interaction between communities / society and these values can be extremely complicated and the cross-sections provide an insight into these relationships. They are not intended as overly simplified representations of the PDZ, but should be viewed in conjunction with the corresponding text for each PDZ. Five zones are represented on the graphics.

These are as follows:

- A – intertidal zone, seaward of the defences;
- B – zone among existing defence lines;
- C – zone between most landward existing defence line and belt of established settlements;
- D – belt of established settlements;
- E – zone landward of belt of established settlements, up to high ground.

The full theme review on which this section is based is provided in appendix D. The theme review identified all features relevant to the SMP, including the benefits, issues and specific objectives associated with each feature.



End of promenade marks boundary between PDZ3 (defended cliffs) and PDZ4 (undefended cliffs) (Courtesy: Borough Council of King's Lynn and West Norfolk)

2.2.2 PDZ1 Gibraltar Point to Wolferton Creek

This PDZ is characteristic fenland, with arable agriculture being the main land use. It has few natural historic or other landscape features, other than some isolated patches of woodland, the four main rivers (Witham, Welland, Nene and Great Ouse) and a collection of man-made drains and a number of traditional windmills. The low-lying Fenland stretches far inland: about 20km to the west, up to over 50km to the south, and then narrowing to about 5km near King's Lynn. All this land is protected by the seabanks around The Wash.

The settlements follow the same pattern throughout the low-lying coastal strip around The Wash. Settlements are generally concentrated in a 'belt' between three and five miles from the shoreline, on slightly higher ground, which also

contains the main roads. The areas between the settlements and the shoreline, and also the area landward of the settlements (the hinterland), are sparsely populated and the land is typically around or below mean sea level. The fresh water levels within the low-lying areas are managed by a network of drainage infrastructure, consisting of drains and pumping stations. The SMP does not develop the plan for management of the drainage system, but it does take account of the assets and the importance of their function.

The SMP considers this large area as one Policy Development Zone because this is the scale of the issues that are important for the SMP. The whole of the PDZ is characterised by a wide low-lying area with good grade agricultural land and a relatively uniform settlement pattern; the shoreline consists of seabanks that protect this whole area against tidal flooding; and finally, the foreshore for the whole area consists of an intertidal area with an important role in flood defence and as a habitat.

Coastal strip

The sparsely-populated area closest to the shoreline contains only a handful of scattered properties and small isolated settlements, such as Leverton Lucasgate, Freiston Shore and Skeldyke. These scattered properties and hamlets are linked by a network of minor roads. Settlement concentration generally increases in a south-westward direction from the Wainfleet/Wrangle area towards Boston/Freiston, and in a south-westerly direction towards the A17 between the rivers Welland and Great Ouse. The settlement of King's Lynn and the River Great Ouse marks the change from extremely wide low-lying fenland to a relatively narrow coastal strip backed by higher ground. Land rises sharply towards the A149 and King's Lynn. There is an Open Category D prison, North Sea camp, located immediately south of Scrane End, near the mouth of the River Witham.

The coastal strip along this PDZ is of high arable agricultural value (most of land is grade 1), and this represents the main land use throughout the PDZ. The Fens grow 37 per cent of the country's vegetables grown in the open, 25 per cent of its potatoes, 17 per cent of its sugar beet and 38 per cent of its bulbs and flowers. The farming and food sectors in the Fens employ 45,000 people and have a turnover of £2.5 billion. In addition there are agriculture-related activities, mainly fruit / vegetable packing factories and food preparation plants, and the intertidal area (the area seaward of the primary defence) is used extensively by the military as a weapons training range, particularly near Holbeach Marsh (the range at Wainfleet was closed in 2009). There are also a number of orchards near the south-eastern limit of the PDZ. In the Boston area a new distribution / industrial park has been built on the A16 at Kirton and on the Endeavour Way Industrial Estate in Sutterton. There is also a landfill site at Slippery Gowt.

The four main rivers in this PDZ provide opportunities for both commercial and leisure river-based industries and activities. There are four main ports in this PDZ, namely Boston, Sutton Bridge, Wisbech and King's Lynn. The ports

at Boston and King's Lynn are the largest, handling steel, timber, grain and paper, and smaller volumes of scrap and bulk cargos (soy meal and salt). A large commercial fishing fleet operates out of Boston, there is a boat yard / marina at Fosdyke, and an inshore fishing fleet also operates out of King's Lynn.

The intertidal area (salt marsh, mud flats and sand banks) also makes a significant contribution to the economy of the area by supporting fisheries, fish spawning grounds and wildfowling.



Paper ship being discharged, Port of Boston

The coastal strip behind the defences is generally of low conservation value, but there are a number of locally-important sites. The RSPB reserve at Freiston, which was established following a recent managed realignment, is important for wildlife, but also for its socio-economic value. There is access to most of the shoreline by public footpath, including the Peter Scott walk from King's Lynn to Sutton Bridge. Finally, the section between the River Great Ouse and Wolferton Creek belongs to the western outlier of the Norfolk Coast Area of Outstanding Natural Beauty (AONB) and displays the characteristic combination of coastal lowland backed by a ridge of higher ground.

The intertidal mud and sand flats are home to a rich variety of invertebrate fauna. The sheltered nature of The Wash and its vast marshes and intertidal habitats make it an exceptionally important site for large numbers of geese, waders and ducks throughout the year. Its sheltered nature also provides good conditions for shellfish that provide an important food source for breeding birds such as the oystercatcher. Also, The Wash holds one of the North Sea's largest breeding populations of common seal as well as a smaller number of grey seals. The sub-littoral area supports a number of different marine communities including colonies of a reef-building polychaete worm.

The intertidal area of The Wash has a number of international designations:

- Ramsar site under the Ramsar Convention – due to the inter-relationship between The Wash's various components including salt marshes, intertidal sand and mud flats and the estuarine waters and the presence of certain species at levels of international importance (for example Eurasian oystercatcher, common redshank and the pink footed goose);
- Special Area of Conservation (SAC) under the Habitats Directive – due to the presence of a number of Annex I habitats such as sandbanks, reefs, large shallow inlets and bays and coastal lagoons;
- Special Protection Area (SPA) under the Birds Directive – due to the fact that the area regularly protects species such as little tern, common tern, bar-tailed godwit, pintail and the common oystercatcher.

Also, the area has a number of national designations. The whole of The Wash area is of exceptional biological interest and is therefore designated as a Site of Special Scientific Interest (SSSI). The intertidal area near Frampton and between the River Nene and Wolferton Creek is also designated as a National Nature Reserve (NNR) as it contains a mix of open deep water, permanent shallow water, mud flat and salt marsh. The area between the River Great Ouse and Wolferton Creek is also part of the Norfolk Coast Area of Outstanding Natural Beauty.

There is a Conservation Area in Terrington St Clement, 3 Scheduled Monuments (the cross in Clenchwarton, medieval settlement remains to the north of Tilney All Saints, and remains of a medieval settlement near Babingley), 29 Listed Buildings (located predominantly in Terrington St Clement, Clenchwarton, West Lynn, and alongside the River Nene), and 385 locally important sites, the majority of which lie within the flood zone, with only a few (30) related to sea defences, saltworking, old wreckage linked to military activity, and maritime activity such as jetties that may be at risk of erosion in the foreshore and shoreline. The historic landscape is dominated by the Parliamentary fen enclosure and drainage of the fens dating to the 19th and 20th Century, with features such as boundaries removed by modern agricultural activities, whilst notable features are centred on the settlements of Terrington St Clement, Clenchwarton, and West Lynn (due to their associated Conservation Areas and Listed Buildings).

Hinterland

Between Gibraltar Point and the River Great Ouse the hinterland is fronted by a belt of established settlements around the main roads (A52, A16, A17, A151 and A47). This belt contains large villages and a number of small towns. Boston, Spalding, Wisbech and King's Lynn are all major urban settlements and have a regional centre function, including various nationally and regionally important historic assets. Inland of the belt of established settlements, the density of settlements generally decreases back to scattered properties between Gibraltar Point and the River Witham. In comparison, along the south-western face of The Wash between the River Witham and

River Great Ouse, there is a higher concentration of settlements, such as Sutterton, Wigtoft, Pinchbeck, Holbeach and Long Sutton. In principle, all the low-lying fenland is protected by the defences around The Wash, and is therefore relevant for this Shoreline Management Plan. This stretches all the way to Lincoln, Peterborough and Cambridge. King's Lynn is a major town with a regional function.

As with the coastal strip, the main land use in the area is agriculture, and this is of national importance. The suitability of land for agriculture is classified in grades, ranging from grade 1 (land with no or very minor limitations to agricultural use) to grade 5 (land with very severe limitations that restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops) (MAFF Agricultural Land Classification (ALC) of England and Wales 1988). The importance of the low-lying area around The Wash to the country's agriculture is illustrated by the fact that it contains almost 50 per cent of England's grade 1 land and almost 10 per cent of its grade 2 land (MAFF ALC 1988).

The hinterland is crossed by a two railway lines (Skegness to Boston and Peterborough to Lincoln) and a network of A and B roads, such as the A52, A17 and B1397, which serve the larger settlements. There are several minor roads that serve the isolated and scattered properties and smaller settlements. The A47 Leicester-Great Yarmouth trunk road, in particular, is a major east-west strategic route linking the Midlands to King's Lynn, Norwich and the east coast, while the A17, although not a trunk road, has a similar strategic function, linking Norfolk with the A1. The PDZ's hinterland is also crossed by a series of power lines and pylons and man-made waterways and drains, such as the South Forty Foot drain and South Holland Main Drain.

The conservation value of the hinterland is limited, and mainly concerns the historic environment (the former medieval estuary of the River Witham at Bicker Haven, remains of banks and salt-making sites), as well as the historic settlements such as Tilney All Saints, Terrington St John, and Walpole.

Cross-section diagrams

Figure 2.8 shows the location of the cross sections in PDZ1.

Figure 2.8 Cross section diagram location plan

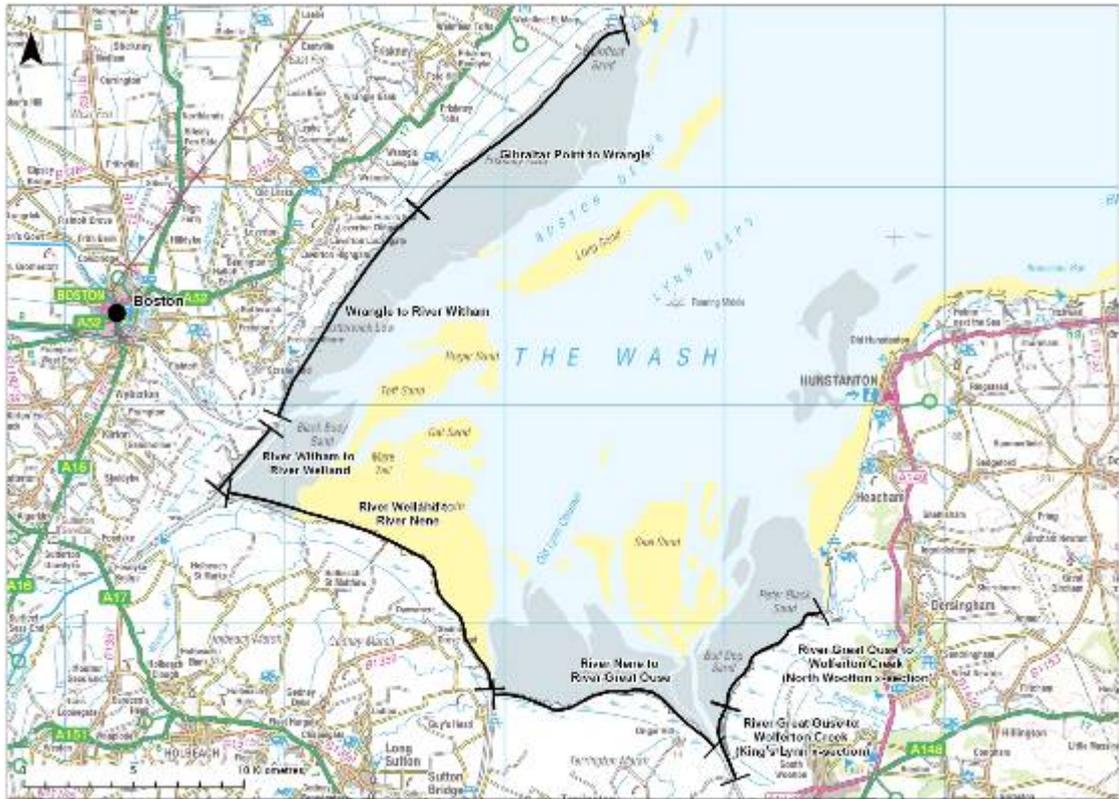


Figure 2.9 Gibraltar Point to Wrangle

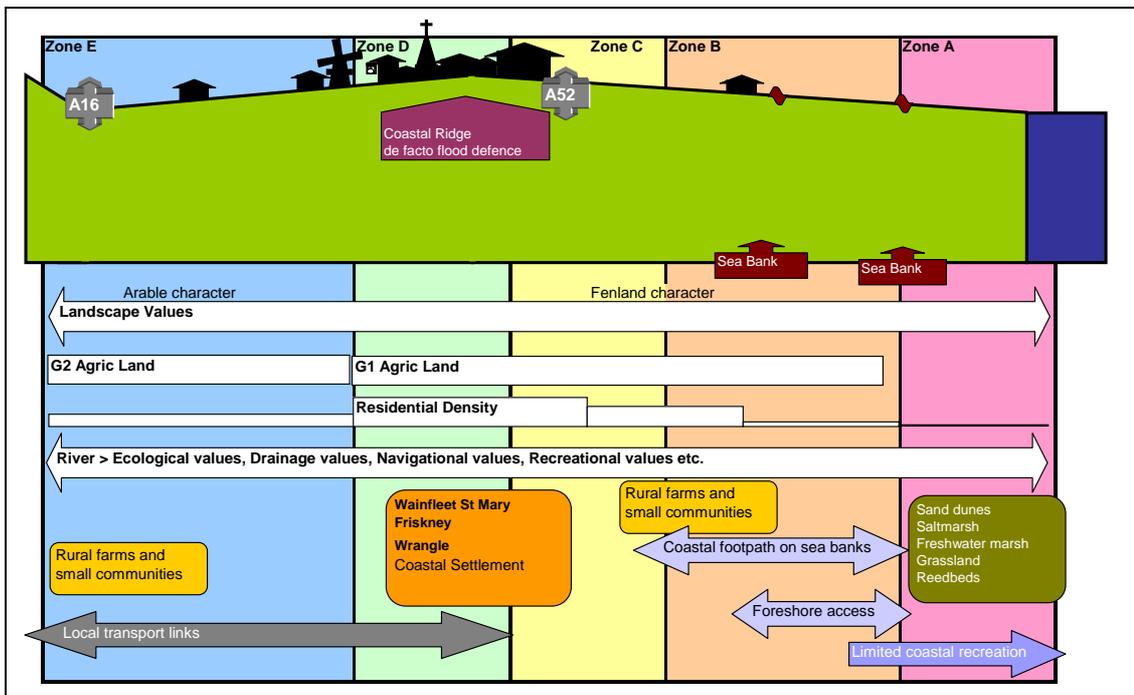


Figure 2.10 Wrangle to River Witham

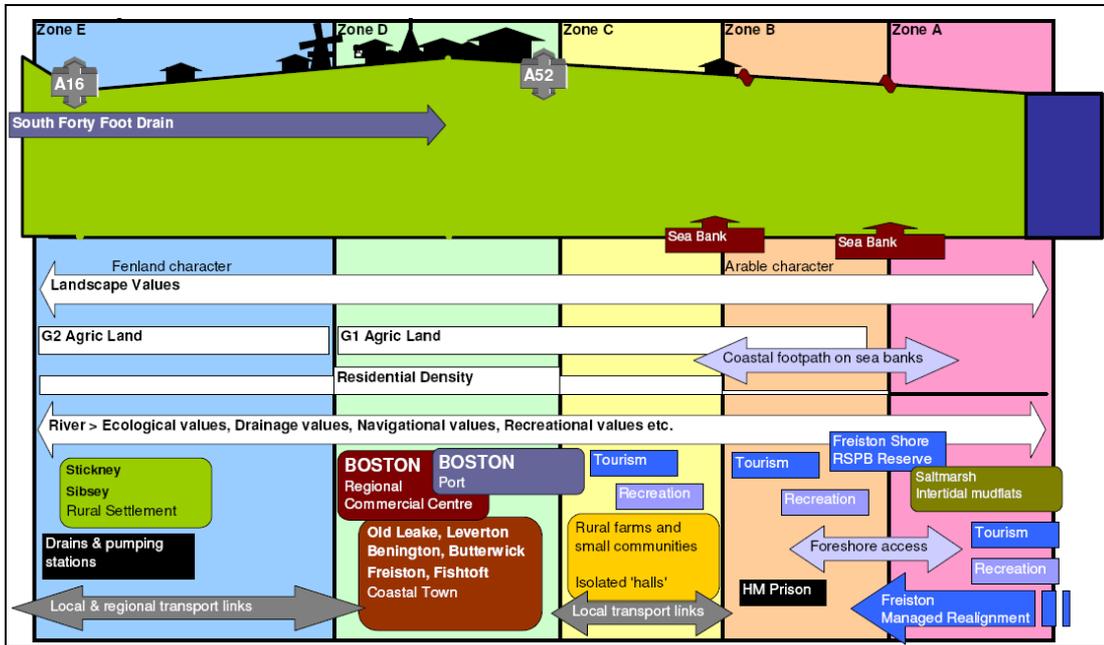


Figure 2.11 River Witham to River Welland

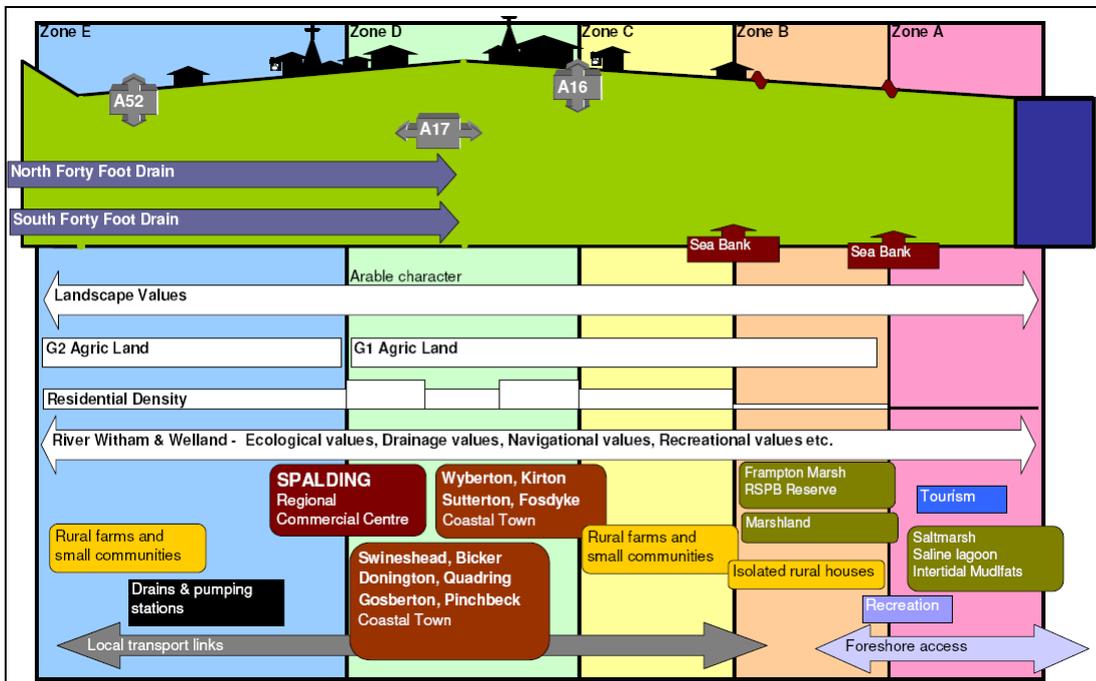


Figure 2.12 River Welland to River Nene

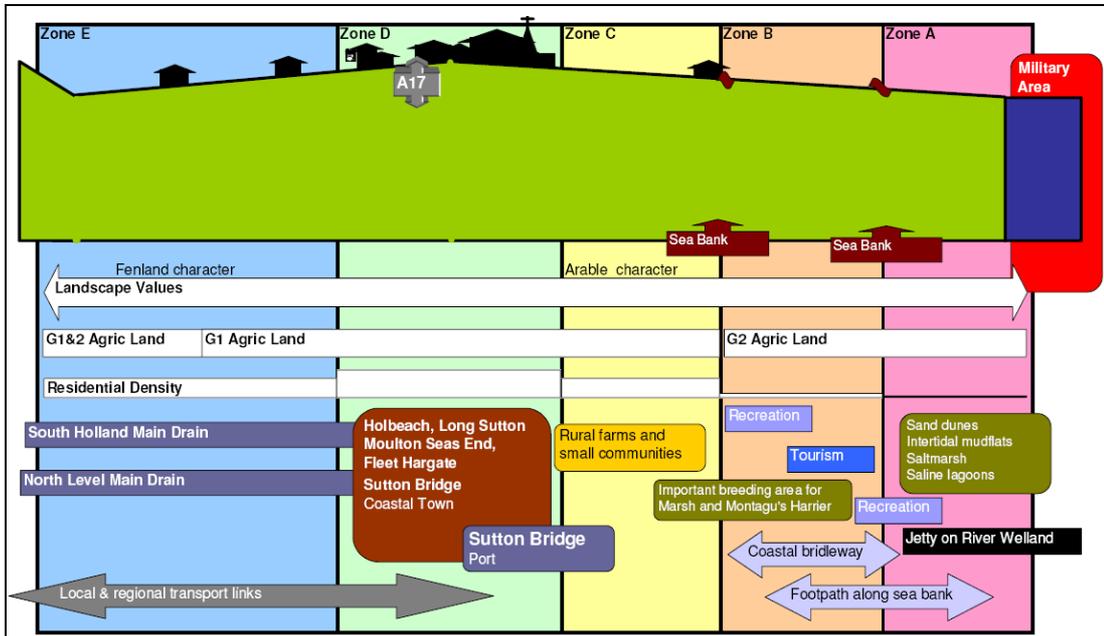


Figure 2.13 River Nene to River Great Ouse

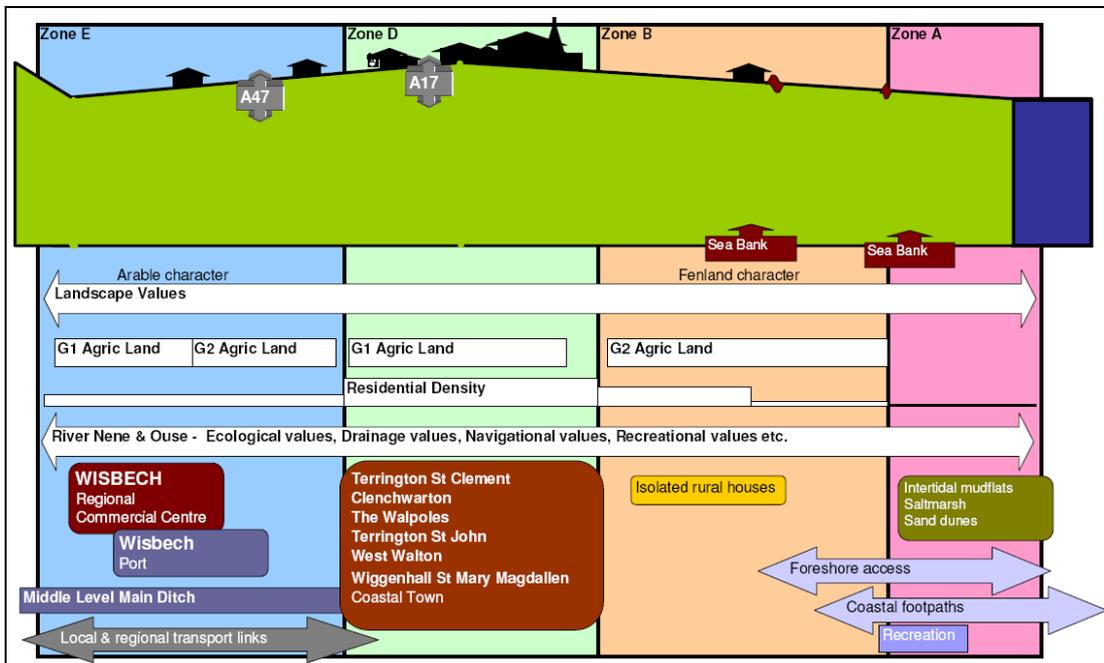


Figure 2.14 River Great Ouse to Wolferton Creek - King's Lynn

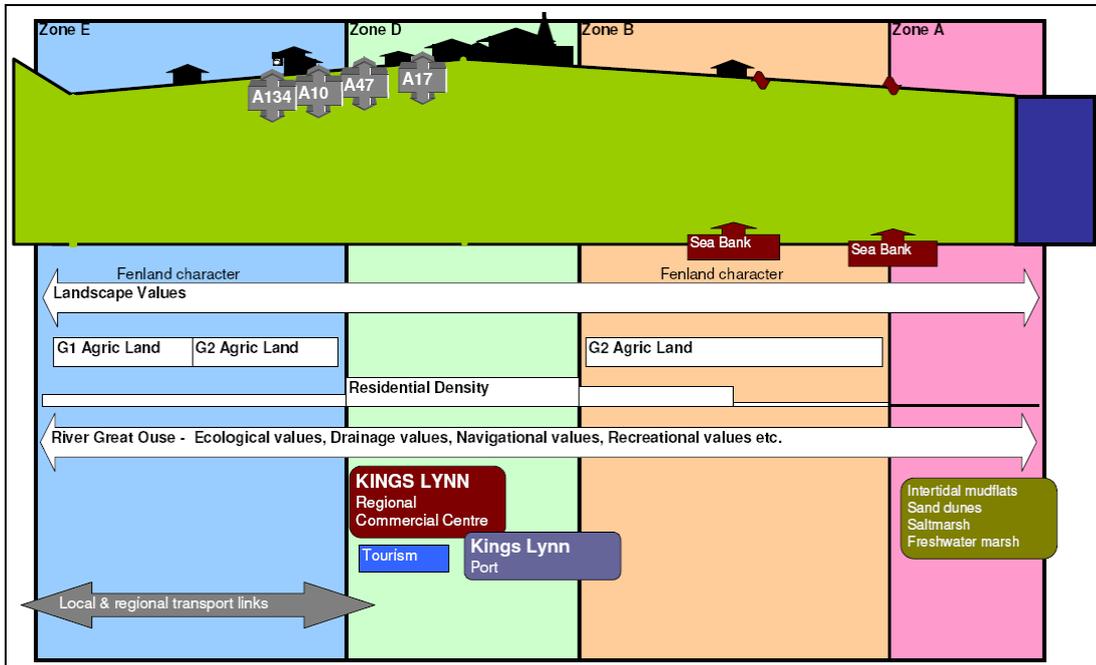
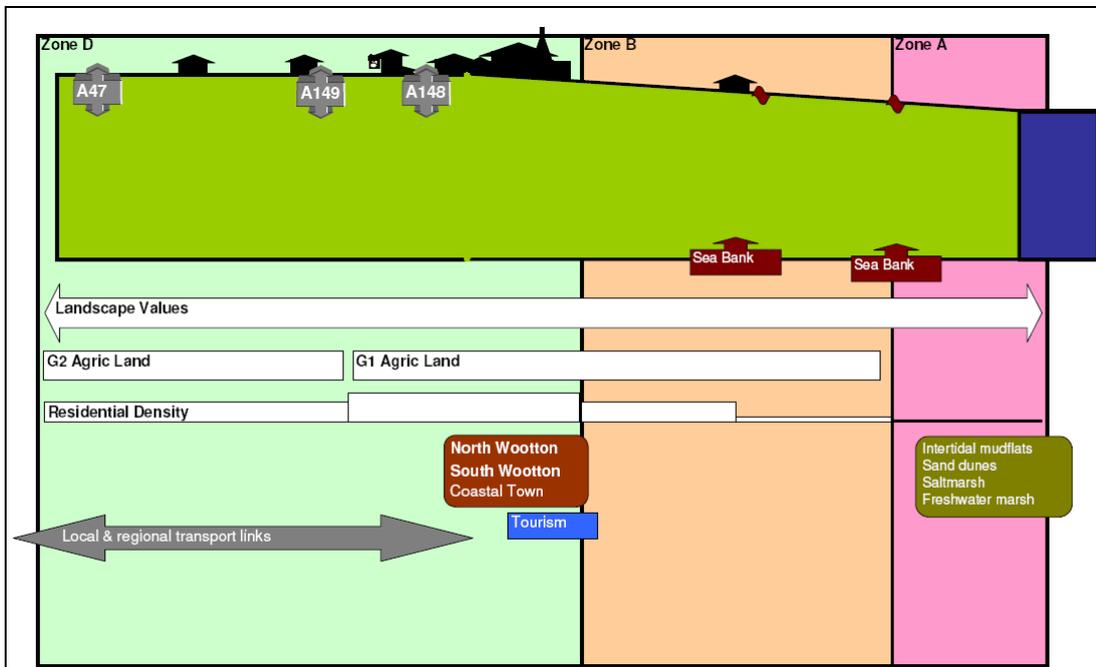


Figure 2.15 River Great Ouse to Wolferton Creek - North Wootton



Possible future changes in land use and environment

There are two key future external developments for this PDZ:

- the likely increase of pressure on the defences and habitat loss as a result of sea level rise and increased storminess;

- the potential need for an increased area of good quality agricultural land to safeguard food security for the United Kingdom in the future..

The combination of these two developments could lead to a situation where there is a strong need to increase the intertidal area in order to sustain the internationally important habitat, while at the same time there is a strong need to keep defending the high quality agricultural land. This is where the socio-economic and the environmental aims of the Government's sustainable development policy come together. The Shoreline Management Plan will have to start finding the right balance, and in the process will have to deal with the existing uncertainty about these future developments.

The SMP has worked together with the Lincolnshire Coastal Study (discussed in section 1.5), which has been developed in parallel with this plan to determine constraints and opportunities for land use in the coastal area of Lincolnshire, to feed into the Regional Spatial Strategy and Local Development Frameworks.

2.2.3 PDZ2 Wolferton Creek to South Hunstanton

This PDZ is not characteristic fenland as with PDZ1. The flat low-lying coastal strip is about 3km wide at Wolferton Creek, and less than 1km wide around Heacham. Its northern boundary is where the high ground reaches the shoreline. From the coastal strip the land rises sharply in an eastward direction towards the A149.

The SMP considers this area as one Policy Development Zone because it is bounded by the distinct Fenland area of PDZ1 to the south and by the high ground (not at risk of flooding) in Hunstanton to the north. The nature of the shoreline, the use of the land and the coastal processes vary along PDZ2, but the interactions are so strong that it requires an integrated approach. This does not preclude that there could be more than one policy unit, see section 3.1. Also, the interaction with neighbouring PDZs, particularly Hunstanton, has to be taken into account.

There are four established settlements along this PDZ. The large villages of Dersingham, Ingoldisthorpe and Heacham lie at the foot of, and partly on, the higher ground. The whole of the settlement of Snettisham is situated on the higher ground, whereas Shepherd's Port (not classed by this SMP as an established settlement) is significantly smaller and located directly behind the earth embankment (which is the secondary defence line). Both Heacham and Shepherd's Port have a distinct coastal character, mainly due to the large concentration of caravan parks, holiday homes and camping sites. There is not much infrastructure in this PDZ, with only a small number of farm tracks and a minor road linking Shepherd's Port and Snettisham, and various roads within Heacham. There are various historic assets of national and regional importance, particularly near Snettisham.

Towards the southern part of the PDZ, the land use is mainly agricultural, but not of the high quality seen throughout PDZ1. Further north the main land use is livestock grazing, with the coastal strip being dominated by tourism-related land use. The area also supports wildfowling.

The higher ground hinterland is famous for its lavender growing and there is a Carstone quarry near Snettisham. Parts of the area belong to the Norfolk AONB and display the characteristic combination of flat coastal lowland backed by a ridge of higher ground. Further inland there are various Sites of Special Scientific Interest (SSSIs), all located on higher ground.

The area in front of the flood defence has a high conservation value because of its internationally important and designated intertidal habitats. It belongs to the same designated sites as the area in front of PDZ1. A summary of these designations is provided below (more detail is provided under PDZ1 in section 2.2.2).

International designations:

- Ramsar site under the Ramsar Convention;
- Special Area of Conservation (SAC) under the Habitats Directive;
- Special Protection Area (SPA) under the Birds Directive.

National designation:

- Site of Special Scientific Interest (SSSI).

As the foreshore is mainly sandy, it also presents a significant amenity and recreational value, in addition to the habitats. This is clearly illustrated by the many caravans and holiday homes located between the shingle bank and the earth embankment, and by the large commercial caravan parks at Heacham and to the south of Hunstanton. There is also a golf course to the south of Hunstanton.



Caravan parks and holiday bungalows, Heacham

On the landward side, this PDZ also has a relatively high number of natural features, including a number of creeks and remnant river channels and a series of water bodies that run the length of the shoreline with conservation and recreation (angling) value. The Heacham River, a chalk stream, also represents a relatively unmodified river in the context of the wider Wash SMP2 area. A series of saline lagoons is located directly behind the shingle ridge south of Shepherd's Port. These lagoons have developed in former gravel pits and are an important refuge for internationally important birds. They are therefore designated as a Special Area of Conservation (SAC) under the Habitats Directive as 'coastal lagoons', as well as a Special Protection Area (SPA).

Part of Heacham Conservation Area is at risk of extreme coastal flooding, as are 2 Scheduled Monuments (moated sites, one in Dersingham and one near Shernborne), and 2 Listed Buildings (the Round House to the south of Snettisham, and Millbridge Nursing Home in Heacham). The PDZ comprises 164 locally important sites, the majority of which lie within the flood zone, with only a few (28) related to sea defences, military activity, and maritime activity such as jetties, though with earlier evidence of saltworking that may be at risk of erosion in the foreshore and shoreline. A Neolithic flint find along the foreshore indicates that some potential for prehistoric sites may exist, whilst a much larger number of finds and sites from the prehistoric to the Roman are identified in the flood zone. The historic landscape character is dominated by rectilinear enclosure and drainage of the fens dating to the 19th and 20th Century, with settlement of 20th Century structures at Heacham dominated by leisure and recreational features. Key notable landscape features are the

two moated sites and the Listed Building near the settlement of Snettisham, and the small Conservation Area in Heacham.

Snettisham and Sedgeford Conservation Areas are present in the hinterland, along with a number of Listed Buildings and Scheduled Monuments centred on Dersingham, Ingoldisthorpe, Snettisham, Ken Hill Wood, and Sedgeford. The historic landscape character in the hinterland is a mix of Parliamentary and 18th and 19th Century enclosure, with medieval and post-medieval settlements at Snettisham and Heacham, with large areas of woodland and parkland, particularly at Ken Hill Wood to the north west of Snettisham, and in the Historic Park and Garden at Sandringham.

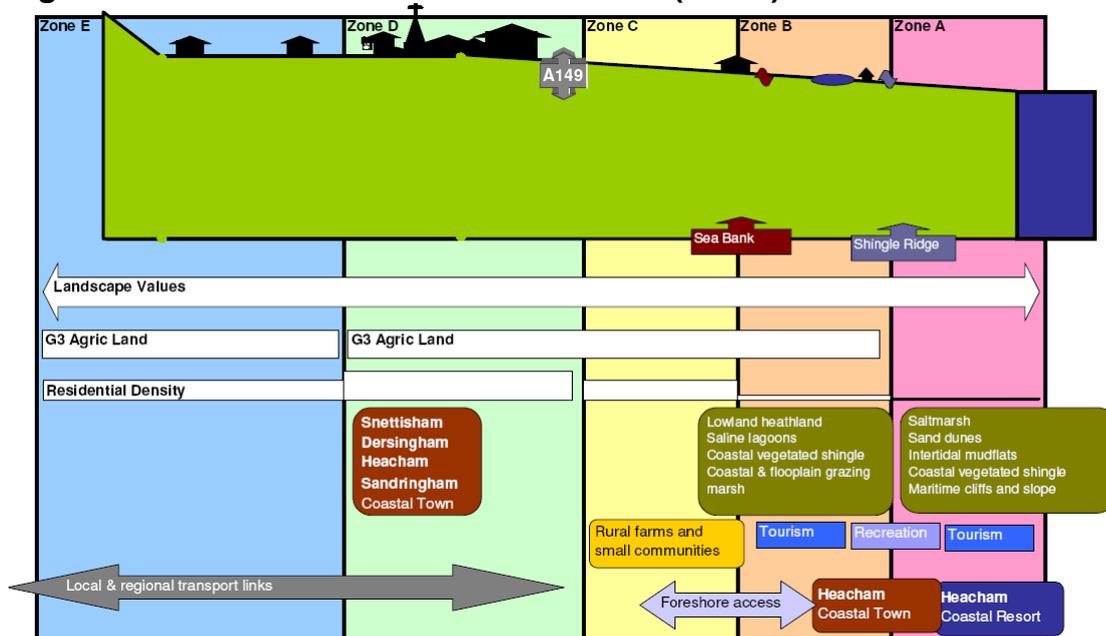
Cross-section diagram

Figure 2.16 shows the location of the cross sections in figures 2.17, 2.18 and 2.19.

Figure 2.16 Cross section diagram location plan



Figure 2.17 Wolferton Creek to Hunstanton (south)



Possible future changes in land use and environment

Generally speaking, the recreational and agricultural use of the area is expected to continue. Future land use between the shingle ridge and the seabank (tourism and saline lagoon habitats) will strongly depend on this Shoreline Management Plan.

2.2.4 PDZ3 Hunstanton town

Hunstanton is a regional commercial centre and coastal resort. It is characterised by the beach, promenade, seaside amenity area and numerous holiday parks. As a result, it provides high quality year-round tourist accommodation and facilities. Hunstanton also contains a number of Listed Buildings and a Conservation Area that are nationally and regionally important historic assets. The town is bounded to the west by the promenade and sea wall, which acts to defend the shoreline, and to the east by the A149, which also has a regional function. This PDZ is located on higher ground, with levels gradually increasing from south to north (from PDZ2 to PDZ3) and from west to east, from the seafront back to the A149.

It is an obvious unit to be treated as a Policy Development Zone, but the interactions with the undefended cliffs to the north and with the flood risk area to the south are essential.

As with the other PDZs, the area in front of the coastal defence has a high conservation value because of its internationally important and designated intertidal habitats. It belongs to the same designated sites as the area in front

of PDZ1 and PDZ2. A summary of these designations is provided below (more detail is provided under PDZ1 in section 2.2.2).

International designations:

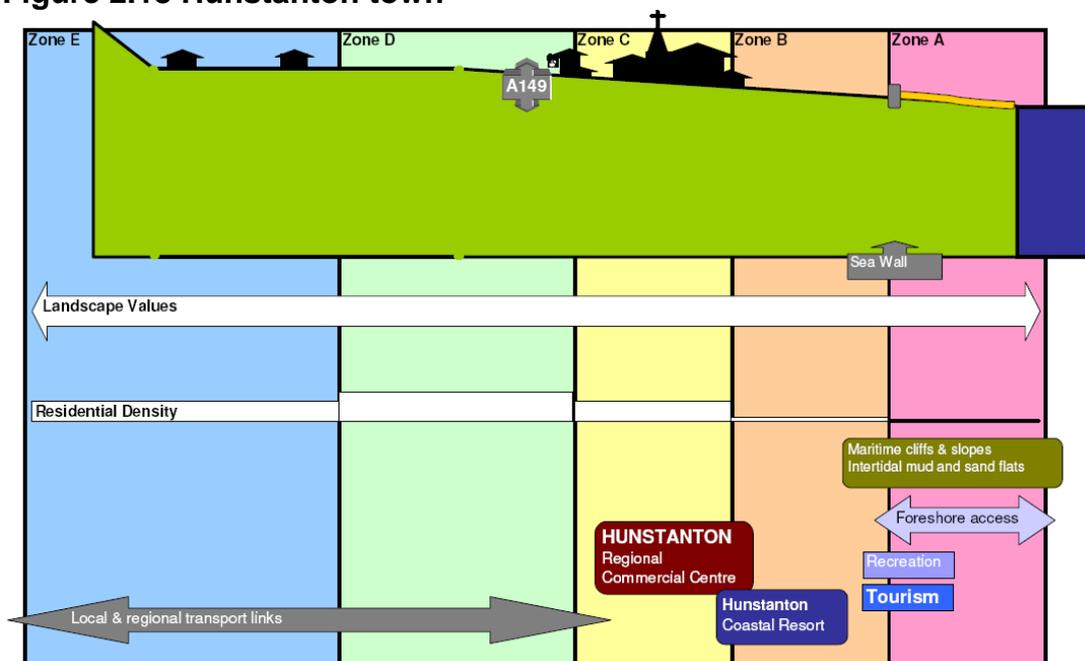
- Ramsar site under the Ramsar Convention;
- Special Area of Conservation (SAC) under the Habitats Directive;
- Special Protection Area (SPA) under the Birds Directive.

National designation:

- Site of Special Scientific Interest (SSSI).

Cross-section diagram

Figure 2.18 Hunstanton town



Possible future changes in land use and environment

It is expected that the town of Hunstanton will continue to develop in its role as a regional commercial centre and coastal resort. This includes a potential redevelopment of the Promenade and the area around it, as part of the Masterplan for Hunstanton Town Centre and Southern Seafront.

2.2.5 PDZ4 Hunstanton Cliffs (undefended)

This frontage consists of the undefended sandstone and chalk sea cliffs, that are between 10 and 20 metres high, fronted by a sandstone foreshore platform. It is an obvious unit to be treated as a Policy Development Zone, but the interactions with the neighbouring north Norfolk SMP and with Hunstanton town are essential.

The cliffs themselves are designated for their geological interest, which benefits from them being undefended. In the southern section of this PDZ, the current cliff edge lies about 100 metres from the road and properties of Hunstanton. In the northern section of this PDZ the cliff top is characterised by a large area of open space (which has a multi-functional use and provides a link between the town of Hunstanton and the cliff top amenities), a car park (used mainly by visitors to the cliffs and beach), a pitch and putt course, tourist facilities (café and toilets) and the lighthouse. There are also important historic assets on the cliff top, including two listed buildings (St Edmund's Chapel and the Lighthouse) and Hunstanton's Conservation Area.

As with the other PDZs, the area in front of the coastal defence and unprotected cliffs has a high conservation value because of its internationally important and designated intertidal habitats. It belongs to the same designated sites as the area in front of the other PDZs. A summary of these designations is provided below (more detail is provided under PDZ1 in section 2.2.2).

International designations:

- Ramsar site under the Ramsar Convention;
- Special Area of Conservation (SAC) under the Habitats Directive;
- Special Protection Area (SPA) under the Birds Directive.

National designation:

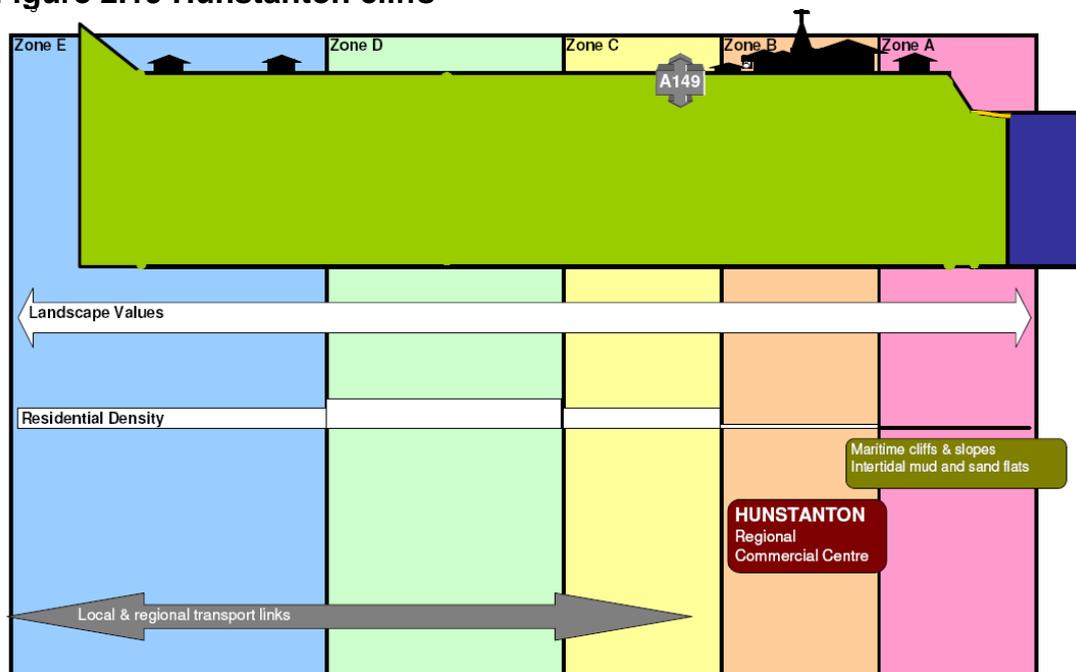
- Site of Special Scientific Interest (SSSI).



Hunstanton cliffs (Courtesy: Borough Council of King's Lynn and West Norfolk)

Cross-section diagram

Figure 2.19 Hunstanton cliffs



Possible future changes in land use and environment

It is expected that the town of Hunstanton will continue to develop in its role as a regional commercial centre and coastal resort. For the open area around the lighthouse, planning policy will prevent development.

2.3 Role of shoreline management

2.3.1 Introduction

This section aims to illustrate how shoreline management can influence the position and nature of the shoreline of The Wash, and the activities and values around it. This is done by setting out two contrasting possibilities for shoreline management, and assessing the effects of these scenarios on the shoreline in terms of the development of the land and level of flood risk. These two contrasting management scenarios are as follows:

- **With Present Management (WPM)** – this scenario assumes that all current frontline defences are maintained to provide the same level of protection as they do now. This includes keeping up with the effects of climate change.
- **No active intervention (NAI)** – this scenario assumes that the defences are no longer maintained and will therefore fail gradually over time. NAI does not, however, involve actively removing the existing defences, so for a time, the defences will provide some residual protection while they are failing.

The role of shoreline management will be discussed for each policy development zone (PDZ), and more detail is provided in appendix F (sections F3 to F6). It is essential to make clear that there is an element of uncertainty in all aspects of the analysis. Specific gaps in knowledge are highlighted in the text, because they need to be addressed in developing the plan.

2.3.2 PDZ1 Gibraltar Point to Wolferton Creek

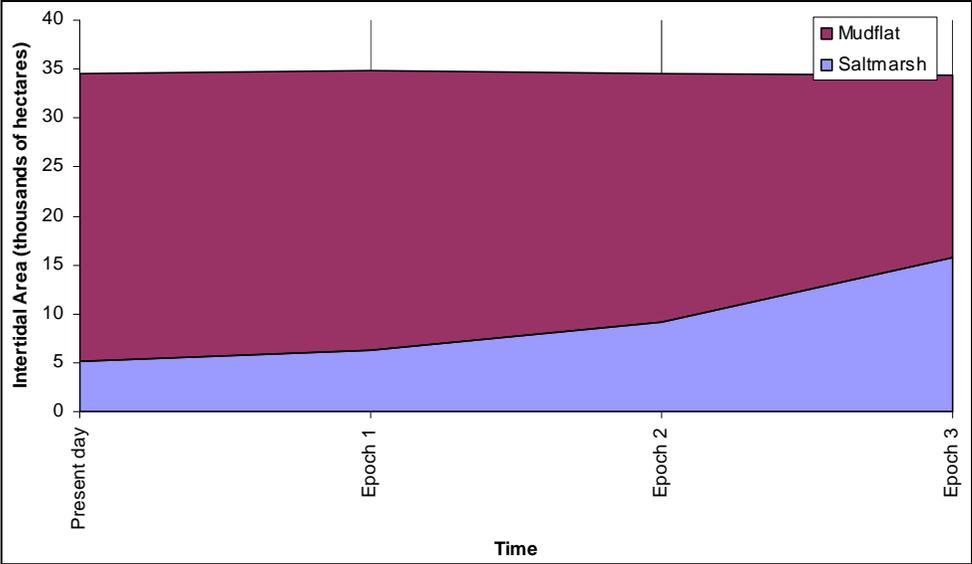
With present management

With present management for this PDZ involves continuing to manage the frontline defence (grassed earth embankments). These embankments are generally managed by the Environment Agency. However there are isolated stretches that are privately managed.

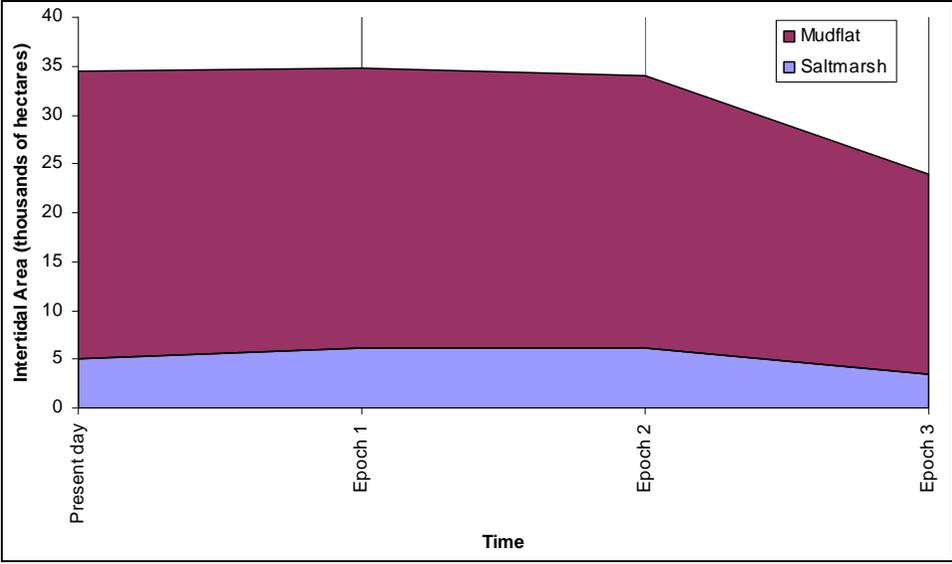
In the short-term (epoch 1) it is predicted that sedimentation will continue across both the salt marsh and mud flat. The predicted rates of sedimentation are likely to exceed the predicted rate of sea level rise, leading to an overall vertical growth of the salt marsh and mud flat, and an overall increase in intertidal area. The salt marsh / mud flat boundary is likely to continue to move seaward as has been noted from recent monitoring. This will lead to an overall increase in total salt marsh area, which will come partly at the expense of the mud flat.

Beyond epoch 1 there is significant uncertainty about how the salt marsh and mud flat will develop. Due to this uncertainty, an 'envelope of potential developments' has been established to illustrate the range of futures that the intertidal area could undergo in the coming 100 years. The graphs in figure 2.20 illustrate the absolute and relative changes to the total salt marsh and mud flat areas, throughout the three epochs and for two extreme ends of the 'envelope'.

Figure 2.20 Envelope of future intertidal development



'Accretional' future



'Erosional' future

- At the accretional end of the scale, the total intertidal area is almost unchanged because the vertical growth of the mud flat keeps pace with sea level rise. It is unlikely to grow significantly due to the presence of the channels. Local changes in both directions will happen, but these have not been picked up by our broad-scale assessment. The accretional approach also assumes continued growth of the salt marsh (within the constraint of sediment availability). This comes at the expense of mud flat area. The current ratio of 15 per cent salt marsh and 85 per cent mud flat could change to an almost 50 / 50 ratio in epoch 3.
- At the erosional end of the scale, the total intertidal area reduces because the mud flat experiences erosion while sea level rises. Within this total, assuming onset of salt marsh erosion, the ratio of salt marsh and mud flat could remain similar to the current situation.
- In reality, the future is likely to be a combination of these two scenarios, but not necessarily on a linear scale between the two. For example, it is within the range of possible future scenarios that the total intertidal area remains roughly constant, while also keeping the same salt marsh / mud flat ratio.

For the sustainability of the flood defences, the presence of salt marsh directly and significantly reduces wave attack, as illustrated in text box 2.1 (page 52). The mud flat also plays an important role, mainly in preventing erosion of the salt marsh. From the point of view of habitats, both the salt marsh and the mud flat provide their own contribution, but their ratio is also important. These considerations will have to be taken into account in developing future shoreline management.

Developments of the intertidal area only have a very limited impact on tide levels. With ongoing sea level rise, the land behind the defences will be increasingly lower than sea levels, and this is the case for both an accretional and an erosional future. In time, this is likely to require additional effort and investment to manage tidal flood risk at an acceptable level and prevent saline intrusion.

No active intervention

Generally, the key difference between the two management scenarios concerns the effects on the currently-defended areas. There will also be different effects on the intertidal areas, but these are likely to be at a more local scale than this SMP can take into account.

During epoch 1, the man-made defences (grassed earth embankments) will deteriorate, partly in a gradual process, but also driven by storm events. Following defence failure (predicted towards the middle to end of epoch 1), there is likely to be some flooding of former reclaimed areas during storm events and on spring tides. The defence will continue to provide some residual protection. To an extent, the spread of floods could be slowed down or even limited by the presence of old secondary lines (even if they do not have a flood defence function any more) and some natural higher ground

(especially between Gibraltar Point and Wrangle). However, in this extreme scenario without maintenance or repair of breaches, ultimately the whole area up to Lincoln, Peterborough and Cambridge would be directly under threat. In practice, land use would have been adapted before this situation arises.

The current intertidal zone is largely expected to develop similarly to the WPM scenario: continued accretion of both the salt marsh and the mud flat. The potential breaches as a result of the NAI policy could cause local channels through the intertidal area, but the effect on the overall trends will be limited.

In the medium-term (epoch 2) the likelihood of significant flooding will increase, and so will the likely area, as the defences deteriorate further and sea level is expected to rise further. Some of the lower-lying areas further from the shoreline would be continuously under water. Towards the end of the epoch, the flooding is likely to be so frequent in places that the initial stages of mud flat formation would be seen on the former reclaimed areas.

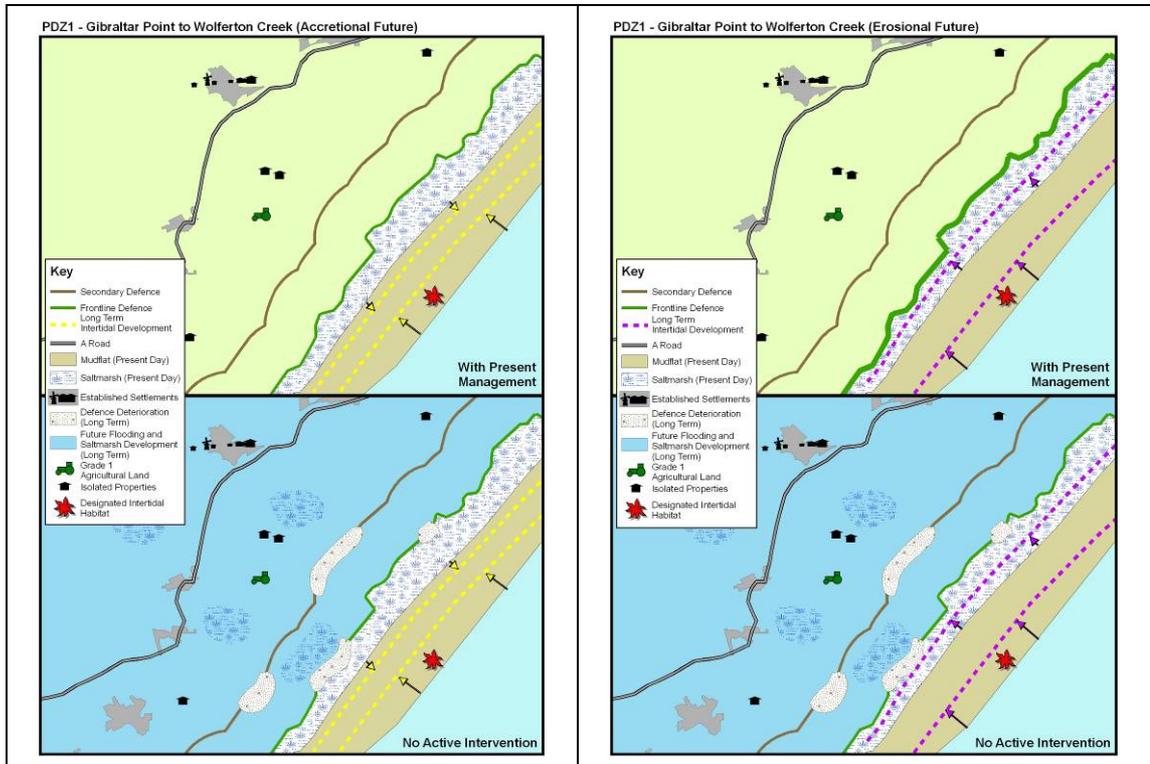
The large-scale development of the current intertidal zone is still largely as described for the WPM scenario: the predictions become more and more uncertain, ranging from continued accretion or stable salt marsh to a reversal of the trend to erosion. Local effects of breaches will increase, but this remains within the bands of uncertainty for the overall trends.

In the longer term (epoch 3), most of the currently reclaimed land would have become intertidal. The overall potential trends for the currently intertidal area would be the same as for WPM (ranging from an overall loss of salt marsh and mud flat under an erosional scenario to continued accretion under an accretional scenario). The constant flow into the new intertidal areas is likely to create salt marsh and mud flat in the newly intertidal areas. This extreme scenario could cause significant overall changes in the configuration of channels and banks of The Wash, and associated land use.

Summary

Figure 2.21 illustrates the two baseline scenarios for both the accretional and the erosional future. At the broad-scale level of the SMP, and with the uncertainty surrounding the coastal processes, the potential development of the current intertidal area is similar for both scenarios. The key difference between the scenarios concerns the effect on the currently-defended areas, and these are obvious. Whereas WPM continues to sustain land use in the defended areas, NAI will require significant adaptation of society, at a local, regional and national scale. This national impact concerns the number of people that would have to move significant distances, and the large area of land which would require a total change of land use. In particular, there would be a national impact from losing approximately 50% of the total area of Grade 1 agricultural land in England.

Figure 2.21: Baseline scenarios for PDZ1



An important outcome of this assessment is that No active intervention is not a realistic option for this particular PDZ. Also, there may be significant issues surrounding WPM. If there is a significant loss of foreshore in the medium and long term, other solutions may be needed to keep providing flood defence and compensate for the loss of important habitats. Section 2.4 will build on these conclusions to identify the 'big decisions' that this plan needs to make.

Text box 2.1 Impact of salt marsh loss on flood defences

The effect of salt marsh loss on the flood defences in a number of representative locations was estimated by answering the following questions:

- How much would the wave loading increase if there was no salt marsh?
- How would we have to improve the defence in order to keep the existing standard of protection?
- How much would that cost?

The answers vary for each site and are only meant to be indicative. Generally, the wave height at the defence could double. The expected sea level rise will in itself already require seabank raising by about one metre, even if the salt marsh does stay in place. The extra wave loading would require an extra seabank raising by at least another one metre, possibly up to 2.5 metres. When the crest is raised, the flood defence also has to be widened by approximately three times the extra height to avoid oversteepening the slopes. This footprint increase can have various implications. The additional weight has to be supported by the subsoil, which can be relatively weak around The Wash. This may need more (costly) provisions, and means that seabank raising may have to be carried out in multiple stages. Also, it is likely that most seabanks not fronted by salt marsh will need a hard revetment (such as concrete blocks) on their seaward slope.

The alternative solution of Managed realignment can also be costly and difficult, especially if a new defence has to be built from ground level. The effects and costs are likely to be much lower if it is possible to upgrade an existing secondary line. The crest height would typically have to be similar to the current primary line, plus sea level rise (assuming that the inland line will not be subject to significant wave loading).

The following table contains an indicative estimate of ballpark costs for these options. Full results of the assessment are described in Appendix F.

Ballpark costs per 10km of shoreline

Future scenario	Policy option	Embankment cost [million £]	Revetment costs [million £]	Total costs [million £]
Accretional	Hold the line	5	0	5
Erosional*	Hold the line	13	2	15
	Managed realignment	11	0	11

*It is not possible at this stage to estimate the potential costs for compensation of land owners (in a Managed realignment option) or habitat compensation (in a Hold the line option). These could be significant and will have to be taken into account in further development of cost estimates.

2.3.3 PDZ2 Wolferton Creek to South Hunstanton

With present management

With present management for this PDZ involves continuing management practices along the shingle ridge, the isolated sections of hard defences and the earth embankment. Managing the shingle ridge will involve annual recycling and reprofiling and repairs following specific storm damage. With present management for the short, medium and long term may need the building of hard defences in place of the shingle ridge if its flood defence function can no longer be sustained.

In the short (epoch 1) and medium (epoch 2) term there are only likely to be relatively small changes in shoreline exposure because the predicted changes in sea level rise and sand bank evolution are relatively small. There is also the potential for a reduction of the wave conditions into the medium term due to changes in how sand banks evolve. The sediment output from the PDZ2 system is expected to be balanced by natural sediment input from PDZ3 and PDZ4 in the short and medium term.

In the short and medium term, the main problem area is expected to be in front of Heacham due to the way it faces (this is a continuation of current trends). As sea levels rise they are likely to intensify the existing sediment divide "effect" in this area, particularly in the medium term. This drift divide occurs because PDZ2's coastline is not straight. This leads to subtle changes in sediment transport along the coast. At Heacham the sand tends to be transported to the north and shingle moves to the south.

Into the longer term (epoch 3) the rate of sea level rise is predicted to outpace sediment accretion across the sand banks. Assuming that no new sand banks develop (an uncertainty) the overall exposure of The Wash as a system would increase, although the effects on this PDZ are uncertain. In addition the sediment divide at Heacham is also likely to continue to increase.

More frequent and intense storms are also likely to occur and this would have the largest effect on the frontage. This is likely to become an issue into the medium and long term and could lead to an increased amount of sediment being transported southwards towards the Scalp and also being drawn offshore. This will also cause increased pressure on the ridge itself, leading to an increased risk of breaching (or conversely, to an increased need for management, both in terms of recycling and possibly hard structures). This will be further increased by the potential reduction in beach levels due to the process of sediment being drawn southwards and offshore. This is likely to be particularly apparent in the area in front of Heacham.

No active intervention

Under a NAI scenario in the short term (epoch 1), the shingle ridge is likely to begin to roll back as it is no longer maintained. If there was sufficient sediment supply, the ridge's crest height would be maintained and may even increase. If there was not enough sediment supply the ridge may become wider and the crest height would be lower. Under this scenario increased overtopping would cause the ridge to deteriorate and gradually break down. As a result, in the short term, the shingle ridge could become more susceptible to breaching and therefore large-scale failure. During storm events, there will be a higher possibility of flooding, although initially the secondary earth embankment will limit the flood extent. The small length of frontline concrete flood defence / promenade to the south of Hunstanton and isolated sections of revetment further to the south will gradually deteriorate, but are likely to remain functional throughout this epoch.

In the medium term (epoch 2) the shingle ridge will continue to roll back, in its wider and lower natural state, but subject to increased overtopping and breach risk as a result of sea level rise. The secondary earth embankment is predicted to reach the end of its functional life in this epoch, which means it will provide only limited residual protection. This management scenario is also likely to result in continued build up of the spit at Snettisham Scalp which has the potential to provide some protection to the section of shingle ridge to the south (which protects the saline lagoons). This again is an uncertainty and depends on the continued availability of sediment and the frequency of storm events.

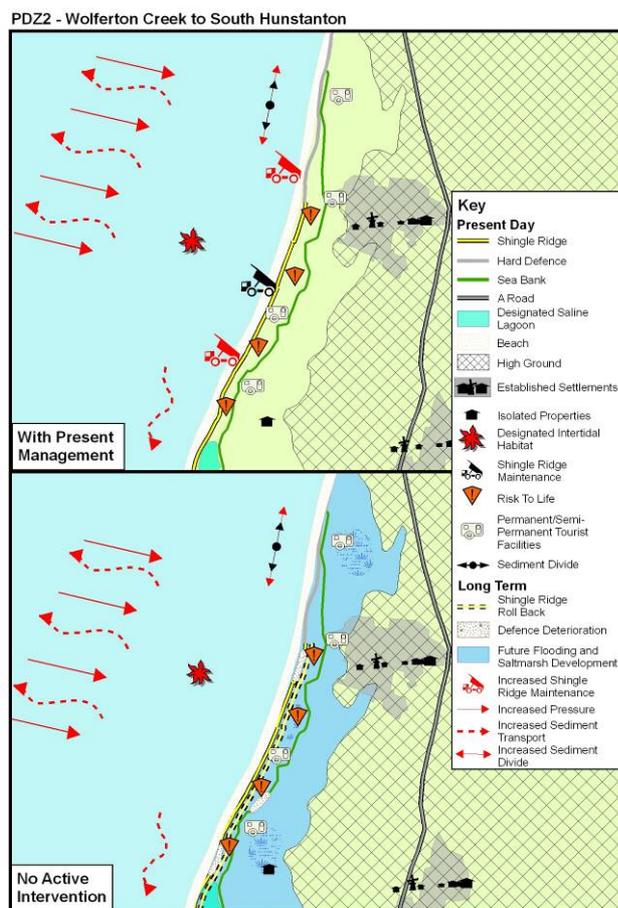
In the long term (epoch 3) there is likely to be regular and significant overtopping of the shingle ridge, with the area of land behind the shingle ridge gradually transforming into mud flat and then salt marsh if enough sedimentation occurs. This could significantly affect the coastal processes along this PDZ, and there are large uncertainties about the nature of this change.

Summary

Figure 2.22 illustrates the two baseline scenarios for PDZ2. Current management of the shoreline in this PDZ is relatively active. There are therefore clear and immediate differences between the two extreme scenarios, especially for land use on and directly behind the shingle ridge. WPM would allow current tourism-based land use to continue on and behind the shingle ridge. The re-profiling would, however, have to happen more and more frequently and at increasing cost, and in time this is unlikely to be sustainable or affordable. Also, there is a significant risk to life arising from the presence of a large number of semi-permanent dwellings directly behind a partly natural and relatively low coastal defence. At this stage it is expected that there would be no need for an increase in management of the shingle ridge to the south of the Snettisham Scalp (the section that protects the saline lagoons) as the spit itself would continue to provide a degree of shelter. There is, however, significant uncertainty about these processes.

At the other extreme, a NAI policy would cause an unmanaged increase of flood risk, including risk to life, for the area behind the shingle ridge (north of the Snettisham Scalp only). This policy is not realistic if no time is provided to adapt land use. Over the longer term it would also affect the features currently protected by the seabank. These changes could have a large effect on the functioning of the whole area, and particularly Hunstanton as a coastal resort. The plan needs to deal explicitly with both the shingle ridge and the earth embankment behind it.

Figure 2.22: Baseline scenarios for PDZ2



2.3.4 PDZ3 Hunstanton Town

With present management

In the short term (epoch 1) there will be continued vertical erosion of the middle to lower beach (the part of the beach that is seaward of the groynes and is therefore beyond their sheltering effect). There is also likely to be continued erosion of the upper beach, particularly during storm events. The sea wall and groynes will continue to provide significant protection against erosion, although the toe of the sea wall may begin to become exposed and

therefore there may be a need for increased maintenance to maintain the current standard of protection.

In the medium term (epoch 2) vertical erosion rates are likely to remain similar to the short term as any effect caused by sea level rise could be balanced by a greater supply of material from increased erosion of the cliffs in PDZ4 (assuming they remain unmanaged). The groynes and seawall will continue to provide significant protection against flooding. However, there is an increased likelihood of exposure of the toe so there will need to be increased maintenance to maintain the standard of protection they currently provide.

In the long term (epoch 3) increased vertical erosion rates across the entire profile are likely as a result of a change in exposure to wave attack coupled with significant sea level rise. Vertical erosion may occur to such an extent that the underlying glacial deposits could become exposed. This would lead to the need for a specific nourishment programme in front of Hunstanton town to make sure the settlement remains an important tourist destination.



Hunstanton town promenade and beach (Courtesy: Borough Council of King's Lynn and West Norfolk)

No active intervention

By the end of epoch 1, most of the hard defences are expected to fail. The sea wall is likely to fail as a result of overtopping causing washout, or by undermining of the toe of the defence causing instability. This will start to cause erosion of the higher ground. There will also be continued vertical erosion of the entire beach profile.

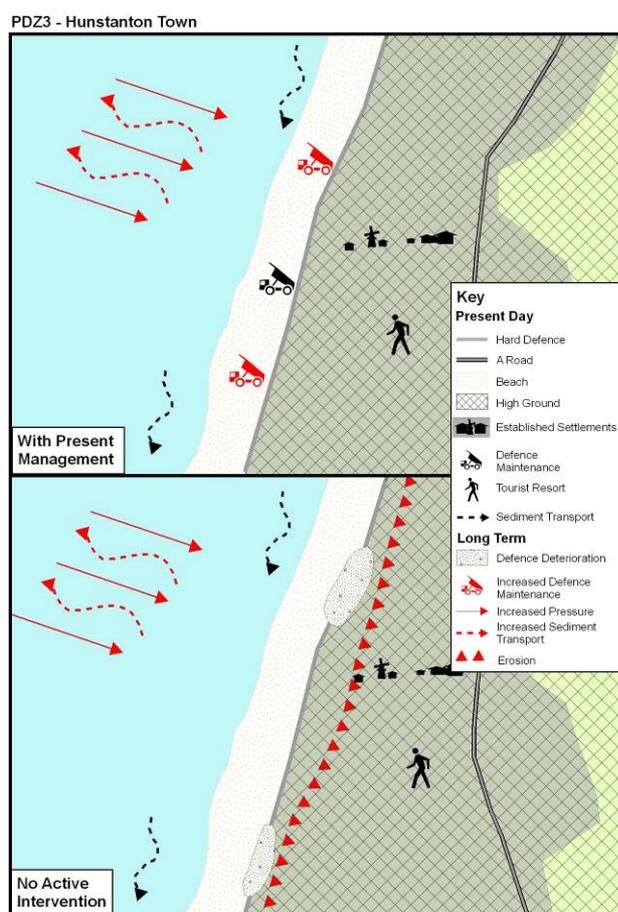
In the medium term (epoch 2), following complete defence failure, it is likely that the shoreline will erode at a similar rate to the undefended cliffs to the north. Rates are likely to be higher initially until the PDZ is at a similar alignment to PDZ4. Vertical erosion of the entire beach profile could remain at similar rates as any effects caused by sea level rise could be balanced by an increased supply of material from increased erosion of the cliffs in PDZ4 (assuming they remain unmanaged).

In the long term (epoch 3) vertical erosion rates across the entire profile are likely to increase due to increased exposure to wave attack coupled with sea level rise. The shoreline will also continue to erode at similar rates to PDZ4 as it is likely to be at the same alignment.

Summary

Figure 2.23 illustrates the two baseline scenarios for PDZ3. The key difference between the two scenarios is obvious, and so is the role of shoreline management for this PDZ. Management of the shoreline is vital for Hunstanton to continue as a viable tourist destination and regional commercial centre.

Figure 2.23: Baseline scenarios for PDZ3



2.3.5 PDZ4 Hunstanton Cliffs

For this PDZ, which currently has a NAI management policy, the other extreme scenario is Hold the line.

With present management (that is, No active intervention)

Hunstanton cliffs are currently not defended and therefore the WPM scenario is the same as the NAI scenario.

In the short term (epoch 1) there is expected to be a continued trend of narrowing of the intertidal zone and a lowering of the beach platform, leading to beach steepening. Predicted average erosion rates are between 0.13 and 0.40 metres a year. However, as noted during recent profile monitoring, these rates are likely to be higher towards the southern limit of the PDZ due to its adverse orientation to predominant weather. The erosion could start affecting the lighthouse (Grade II Listed Building).

Into the medium term (epoch 2) the short-term trends are likely to continue. Predicted average recession rates are between 0.27 and 0.85 metres a year, with a focus of wave aggression (and therefore erosion) being towards the south. Higher rates of erosion could also occur in the north due to the continued lowering of the beach platform reactivating cliff toe erosion.

In the long term (epoch 3) erosion rates are predicted to be between 0.5 and 1.5 metres a year. Early on in this epoch, the erosion would start to threaten the road and properties in the southern half of the PDZ.

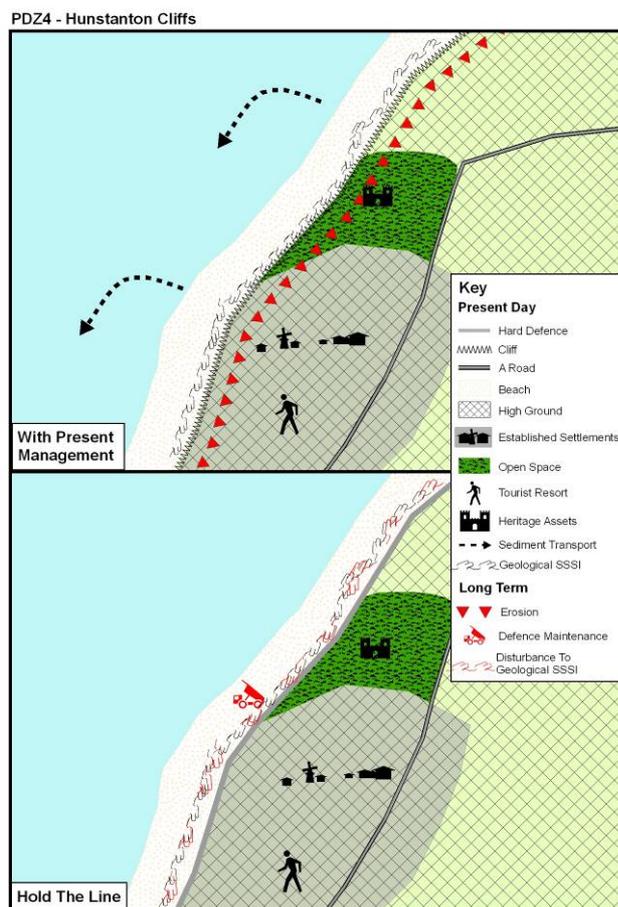
Hold the line

Building new defences at the toe of the cliffs could prevent their erosion. This would, however, have local effects (as the erosion of the cliff face would no longer feed sediment to the beach platform) and could affect the Hunstanton town frontage (discontinuing its supply of sediment from this source).

Summary

Figure 2.24 illustrates the two baseline scenarios for PDZ4. The key differences between the two scenarios are obvious. Continuing the existing No active intervention policy is a vital element of the cliffs' geological designation and releases sediment which could have a positive impact on the beach levels in front of Hunstanton. Building defences in the short term would save the lighthouse and other historic features and maintain the current extent of the green, but for most other features a much later intervention would be sufficient. The SMP needs to make the decision whether this intervention is needed, and if so, when.

Figure 2.24: Baseline scenarios for PDZ4



2.4 Sustainable shoreline management: Finding the right balance

2.4.1 The 'big decisions' for The Wash Shoreline Management Plan

The preceding sections show that the shoreline of The Wash poses some very particular challenges for shoreline management, which are essential for the future of the area itself and could also be significant on a regional or even national scale. Particular ways of managing the shoreline will benefit some of these values and land uses, but damage others. The aim of this Shoreline Management Plan is to develop a plan that achieves the right balance between all these values. This is reflected in the set of principles that was agreed among all organisations involved in developing this SMP (see section 1.4), and the associated objectives (see text box 2.2, page 61).

Section 2.2 identifies for each PDZ the values and land uses that can be influenced by shoreline management. The big decisions that the SMP has to make are driven by these values. The two scenarios from section 2.3 both have negative effects for certain values, so in reality there may be opportunities to develop a win-win plan that does benefit all values and land uses. However, there are also cases where hard decisions have to be made because the interests are conflicting. For such cases, it is essential that the

plan aims to provide sufficient time for adaptation, for people, businesses and other organisations.

For The Wash, the 'big decisions' that shoreline management needs to make are different for each of the four policy development zones. They can be summed up as follows:

For PDZ1, Gibraltar Point to Wolferton Creek:

1. Based on the typical pattern of settlement and land use around The Wash, it is not realistic to stop defending against tidal flooding for the established settlements and their hinterland. There is therefore no need to do full appraisal of No active intervention, or of realignment options beyond the settlements. The 'big decisions' for this PDZ concern the question **how to achieve continued defence against flooding** of the established settlements and the low-lying area behind them.
2. For this particular PDZ, the **degree of tidal flood risk** is an essential element of shoreline management planning (much more so than for other SMPs and the other PDZs in this SMP). It is beyond the scope of the SMP to determine a required standard of protection, but the SMP can make decisions about the relative level of flood risk in the face of climate change to be achieved by flood risk management. For this PDZ therefore, one of the 'big decisions' is whether to sustain the existing activity level (accepting gradual increase of risk), increase the activity level to sustain the existing level of risk, or even aim to reduce flood risk. To this end, CFMP-defined flood risk policies have been referenced to provide an indication of future intent. (See Appendix E, section 3 for a full description of their usage in the SMP process).
3. **Sea level rise and potential future loss of foreshore** width and height would increase pressure on the defences. Loss of foreshore would also affect the integrity of the habitats in The Wash. If the foreshore was lost, holding the existing alignment would preserve valuable agricultural land, but it would lead to loss of important habitats and species and require large and expensive defence structures. The alternative would be to carry out localised realignment of the defences (where needed). Based on point 1 above, these would be limited to the zone seaward of the settlements. Such localised realignments would come at the cost of agricultural land, require adaptation of drainage infrastructure and defence investment, but they would create intertidal habitat and provide a more sustainable flood defence for the settlements and the area behind them. The SMP needs to determine the right balance between these factors.
4. The Wash is a complex area that is sensitive to a number of **uncertainties**. These concern the response of the foreshore to climate change and to any change in defence alignments. Other uncertainties

concern future developments with regard to the value to society of intertidal habitats and of high quality agricultural land, and the associated national policy. The SMP needs to make sure that the plan is both robust and flexible in the face of these uncertainties. Appendix E4.2.2 analyses the sensitivity to the main uncertainties, with a more detailed assessment for climate change and coastal processes in appendix F6.

For PDZ2, Wolferton Creek to South Hunstanton:

1. Continuing the current approach of using the shingle ridge as a frontline defence will be difficult beyond the short term. This is because **it may not be affordable**, there is already a significant **risk to life** for the people directly behind the defence and the **environmental effects** could become unacceptable.
2. No active intervention on the shingle ridge would require **large-scale land use adaptation**. Adaptation at the scale needed is not realistic in the short term. In any case, it would have a large effect on the role of this stretch of coastline as a tourist destination.
3. The SMP has explored other options, for example a gradual move to a 'wide defence zone' approach. This would provide time for adaptation by holding the frontline during epoch 1, but ensures that this period would be used to adapt land use on and behind the shingle ridge. From the start of epoch 2, following land use adaptation, the shingle ridge would no longer be maintained as a frontline defence. From then, the existing seabank would perform this role, supported by the more natural shingle ridge, with upgrading of the seabank as far as needed to provide appropriate protection. This line would then be held during epochs 2 and 3. However, appraising this option has shown that this would also be difficult to sustain (see appendix H section H3.2). It would also need large-scale adaptation and would possibly continue the undesirable situation of people living directly behind a defence with a relatively low standard of protection. In conclusion, it appears that **any solution for this area is likely to be challenging**.
4. There are **important habitats on both sides of the shingle ridge**. The shingle ridge protects the saline lagoons, which are an important and rare habitat. Keeping it in its current alignment may also constrain long-term development of the intertidal area.
5. This illustrates that the situation in this PDZ is very complicated. It is difficult to apply the standard policy options to this complicated situation. Developing a long-term sustainable and realistic solution requires more knowledge than the SMP process currently has or can produce. It also requires a longer and more **integrated decision-making process** than this SMP review can provide. In this case, the role of the SMP has to be

to initiate and then support this integrated decision-making process, with full involvement of all partner organisations and local stakeholders.

For PDZ3, Hunstanton Town:

1. Continued defence against erosion of the Hunstanton seafront is needed to support continuation of **the town's role as a regional centre and tourist destination**. A judgement-based assessment for this SMP has suggested that the associated benefits for Hunstanton and the region are likely to outweigh the cost of continued defence, which is likely to increase as a result of climate change.

For PDZ4, Hunstanton Cliffs:

1. The cliffs are currently not defended. Their ongoing erosion is likely to be a source of sediment for Hunstanton town and further south and provides an important geological interest and landscape feature. On the other hand, erosion is likely to threaten the lighthouse, which is a Listed Building, as well as part of the Hunstanton Conservation Area, as well as recreational use of the cliff top in the short term, and may start to threaten the cliff top road and houses in the long term (including St Edmund's Chapel which is a Listed Building). The SMP needs to find the **right balance between these factors**.

2.4.2 Moving forward to solutions

These considerations have steered the development of the Shoreline Management Plan. For each of the four policy development zones, options that represent the various sides of the arguments have been developed, including providing time for adaptation to large changes.

The Shoreline Management Plan contains policies based on a full appraisal of all the factors against a wide range of objectives (see text box 2.2 on page 67) that are based on the principles listed in section 1.4. All relevant options were scored against the objectives, using quantitative and qualitative indicators as appropriate. The results were visualised using a traffic light colour system, which was used to validate the results with the partner organisations and to support their decisions about the policies. The policy statements in section 4 include this visualisation of the appraisal results for the selected policies.

Text box 2.2 Illustration of objectives for appraisal

The policy appraisal objectives were developed for each specific frontage based on locally-specific features, values and issues, and are fully listed in Appendix E. This text box illustrates the nature of the objectives used in the appraisal.

Flood and erosion risk management

- Maximise the use of existing man-made or natural defences (e.g. salt marsh): the inland lines of (historical) defences and the ridge of higher ground between Wainfleet and Wrangle
- Have as little flood and erosion risk management throughout the plan period as possible

Communities

- Protect as a minimum, throughout the plan period, to an appropriate standard of protection, all established settlements and the area landward from these settlements
- Protect as many settlements as possible.

Habitats

- Maintain natural processes relating to mud flats, salt marsh, sand dunes and saline / coastal lagoons (where present)
- Maintain and if possible increase the area of mud flats, salt marsh, sand dunes and saline / coastal lagoons (where present)

Agriculture

- Protect as much grade 1 and grade 2 lands as possible.
- Ensure that the impact on the UK's area of grade 1 and grade 2 lands is acceptable.

Infrastructure

- Avoid interruption of the functioning of ports
- Avoid interruption of the drainage function of Rivers throughout the plan period
- Avoid interruption of transport connections and utility supply throughout the plan period

Historic environment

- Preserve historic environment assets in situ where feasible

Landscape

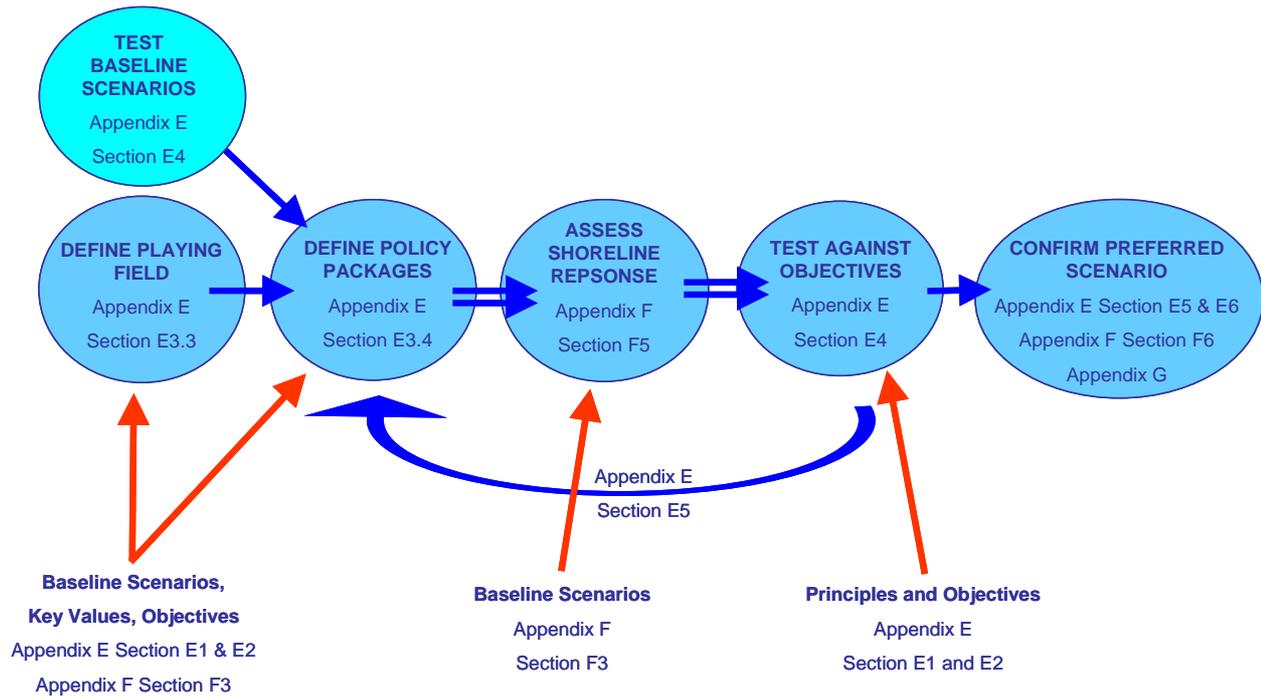
- Maintain the integrity of the coastal landscape

Timing

- Provide sufficient time, if required, for community adaptation
- Provide sufficient time, if required, for change of flood risk management practices
- Provide sufficient time, if required, for relocation of regional infrastructure and navigational infrastructure changes, ensuring continued A-road and rail transport links and links between the communities
- Provide sufficient time, if required, for adaptation of smaller ports
- Provide sufficient time, if required, for recreational access to the foreshore
- Provide sufficient time, if required, for relocation / adaptation of MoD use of the foreshore (where applicable)
- Provide sufficient time, if required, for relocation / adaptation of prison facilities (where present)
- Provide sufficient time, if required, for relocation / adaptation of sewage works (where present)
- Provide sufficient time, if required, for appropriate mitigation of loss or damage to historic environment assets if preservation in situ cannot be achieved

The full process of option development and appraisal is described in appendix A (section A2.3), with references to more details in the other appendices. The process is also illustrated graphically in figure 2.25. This main SMP report focuses on the final plan. Section 3 describes the plan and what it means, while section 4 describes the specifics of the plan for each policy development zone.

Figure 2.25 Option Development and Appraisal



3 General description of the plan

3.1 Overview

The overall plan for managing the shoreline of The Wash is to take a no-regret approach in the face of very uncertain future developments, and to set out a clear programme of monitoring, study and collaboration to support long-term decisions.

The specific situation is very different in the four policy development zones that this SMP has defined, and this is reflected in the plan. The policy development process has confirmed that the four policy development zones identified in section 2 can be treated as policy units at the level of the Shoreline Management Plan. The SMP therefore describes the plan per PDZ.

Policy development zone 1: Gibraltar Point to Wolferton Creek

The intent of management for this area is to sustain flood defence for the communities and their hinterland in the low-lying areas around The Wash. In the short term the intent is to hold the existing seabank alignments. In the medium and long term, the choice of approach has to be driven by the development of salt marsh and mud flat. Based on current knowledge, this could range from significant overall loss to a situation where the existing intertidal area broadly remains. A loss of foreshore would increase pressure on the defences because the foreshore limits wave attack. It would also affect the integrity of the habitats in The Wash. If a loss of foreshore occurs that increases pressure on the defences and affects the integrity of the habitats in The Wash, then the intent is to carry out localised managed realignments (when needed and as far as needed). This will provide a more effective and sustainable sea defence solution by creating a wider foreshore as well as helping to conserve the natural environment. As for all SMP policies, this is based on the current legal and policy framework and existing knowledge; the plan's regular reviews will take into account any developments that may influence the policy.

The SMP has identified that more knowledge is needed to confirm the likelihood of this possible loss of foreshore. So the medium-term and long-term policies are conditional on the results of ongoing monitoring and research. The SMP's action plan therefore contains a specific programme of actions (monitoring, consultation and studies) to improve predictions of intertidal developments and understanding of the effect of foreshore loss on flood defence and habitats. The increased knowledge will help to determine the need for localised realignments, and inform their timing, location and extent, aiming to optimise defence sustainability and to compensate for the expected deterioration of intertidal habitats.

Policy development zone 2: Wolferton Creek to South Hunstanton

The intent of management for this area is to jointly develop a sustainable long-term solution based on cooperation between the partner organisations and all people and businesses with an interest in the area. This process has already started through a pre-consultation stakeholder meeting on 24 August 2009.

The SMP process has identified that the situation is very complex and sensitive. The presence of a large number of people directly behind a relatively low standard flood defence is undesirable. However, even the existing defence standard will be difficult to sustain into the future because the shingle ridge needs continuous maintenance, with costs and environmental effects that are likely to increase. However, the holiday homes and caravan parks that the defence protects are very important for the local and regional economy. Finally, there are no obvious alternatives.

In the short term, the intent is to hold the existing frontline defences where they are now. This applies to both the earth embankment at South Hunstanton and the shingle ridge and isolated sections of sea wall / revetment. The period up to around 2025 is the minimum time needed for any land use adaptation that may be needed. It is essential that the current efforts to manage risk to life are sustained. The costs and the environmental impacts are considered acceptable, but this will need to be confirmed by the review of the flood risk management strategy planned for 2012. The caravan site owners and residents have indicated they are likely to want to contribute to the funding, but it is possible that a process of land use adaptation will have to start before 2025.

For the medium and long term, the plan will need to be developed through a partnership approach with all relevant people, businesses and organisations involved, as initiated through the pre-consultation meeting on 24 August 2009. The SMP's action plan sets out these next steps. The best option is likely to be a mixture of flood defences (making use of existing defences, upgrading old defences or building new defences), incident management and land use changes. The long-term solution will have to limit risk to life to an acceptable level, provide enough time for adaptation, support Hunstanton's socio-economic role, be legally compliant in terms of the protected habitats and be realistically fundable, which is likely to require third party or local contributions. Again, there are strong indications that the caravan site owners and residents would be willing to make significant funding contributions to achieve a Hold the line policy.

Policy development zone 3: Hunstanton town

The intent of management for PDZ3 is to sustain the viability of Hunstanton town as a tourist resort and regional commercial centre. The intent is to hold the shoreline defences where they are now. There will be a need to monitor long-term development in relation to the neighbouring frontages.

Policy development zone 4: Hunstanton cliffs

The intent of management for this PDZ is to continue to allow the cliffs to erode naturally and provide sediment to help maintain the beaches to the south in PDZ3, up to the point where the erosion starts to threaten cliff top properties and the B1161. It is uncertain when this would occur, but based on current knowledge this is likely to occur towards the very beginning of epoch 3 (around the year 2055). From that time on, the intent is to prevent further cliff erosion to sustain the properties and the road.

Continued No active intervention has various positive and negative impacts (see section 3.2), and so does the long-term intent to stop the erosion. For that reason, the SMP has identified the need for an integrated strategy study for the interdependent frontage from Old Hunstanton to Wolferton Creek (PDZs 4, 3 and 2).

3.2 Implications of the plan

The plan mainly describes how the shoreline will be managed, but this has been driven by, and will have implications for, a range of functions, features and values. The overview of the plan in section 3.1, and the policy statements, touch on the most relevant implications. This section describes the implications in more detail for a range of aspects.

The Strategic Environmental Assessment (SEA) process that accompanies the SMP intends to make sure that environmental and socio-economic issues relating to the coast are central to developing and evaluating policy. The SEA therefore provides the means to support a structured evaluation of the key environmental and socio-economic implications of the plan for The Wash. The SEA report evaluates the effects on an established suite of receptors in a targeted and specific manner. The evaluation in this section is consistent with the SEA, but uses the categories identified in the SMP guidance.

Property and infrastructure

For PDZ1, the plan provides continued flood defence at an appropriate standard for all established settlements and their hinterland and all A-roads and railways. Based on the current forecasts of intertidal development and potentially associated needs for localised landward realignment, continued protection is also likely for all hamlets and isolated dwellings and ongoing infrastructure in this PDZ, but there could be a need for adaptation of drainage infrastructure.

For PDZ2, the long-term plan to be developed in cooperation with all involved could affect the holiday homes and caravan parks in the area, and may even affect some low-lying permanent properties at the edge of the settlements. The plan does provide continued flood defence for all properties and infrastructure during epoch 1.

For Hunstanton town (PDZ3), the plan provides continued defence against erosion of Hunstanton's seafront, including all properties and infrastructure behind the earth embankment. For Hunstanton cliffs (PDZ4), cliff erosion is likely to affect the Grade II Listed lighthouse in the short term. It may start to threaten the listed St Edmund's Chapel, other cliff top properties and the B1161 toward the middle of the century. The intent is to prevent further erosion in order to sustain the properties and the road, but this will need to be confirmed at a later stage.

Communities and local economy

The plan provides continued flood defence for all settlements, but a community is much more than a collection of buildings.

For PDZ1, continued protection of the settlements and their hinterland supports the communities and the socio-economic role that agriculture plays. If significant loss of foreshore does occur in the medium and long term, the associated localised realignments will have a negative socio-economic effect due to loss of agricultural land, but a positive effect on fisheries, shellfisheries and tourism activities that depend on the intertidal areas.

For PDZ2, the proposed joint plan could involve some form of land use adaptation, which would have temporary and possibly permanent effects on the important role that tourism plays for the area. As with PDZ1 the impact on coastal processes could affect fisheries and tourism activities that depend on the intertidal areas.

For Hunstanton town (PDZ3) and Hunstanton cliffs (PDZ4), the plan intends to sustain and support the current socio-economic role of Hunstanton town and its seaside, although continued cliff erosion and possible associated loss of heritage assets and tourist attractions on top of the cliffs could also start to have a negative socio-economic effect.

Land use

For PDZ1, the plan generally intends to sustain current agricultural land use in the Fens by providing continued flood defence at an appropriate standard. However, this continued protection may require localised landward realignment (in case of an erosional future scenario) which would come at the expense of agricultural land directly behind the defences. Based on current predictions of intertidal development under an erosional future, and assuming that the localised realignment would compensate for all lost intertidal land, the potential loss of agricultural land could be up to three per cent of total grade 1 and 2 land in the low-lying area around The Wash, which is about 0.5 per cent of all grade 1 and 2 land in England. In firming up the future plan in the coming years, this effect will have to be assessed both on a local, regional and national level, taking into account emerging insights and policy on food security. If localised realignments occur, any affected drainage infrastructure will need to be adapted to continue functioning for the rest of the area.

For PDZ2, the proposed joint plan may have an effect on all low-lying land in this area, including the defended grade 3 and 4 agricultural land, which is abundantly present in the area and nationally.

For Hunstanton town (PDZ3) and Hunstanton cliffs (PDZ4) the plan has no implications on land use.

Wildlife and geology

For PDZ1, holding the current alignment in epoch 1 is not expected to have a negative effect on the important intertidal habitats, which are expected to continue their current accretion. In the medium and long term, when there could be a loss of salt marsh, mud flat or both, the intent is to ensure that any negative effect on the integrity of intertidal habitats caused by coastal squeeze is mitigated or compensated, as required under the Habitats Regulations, for example through localised managed realignment. The Environment Agency's Regional Habitats Creation Programme (RHCP) could be an appropriate delivery mechanism. The plan will set in motion a focused programme of monitoring and study to improve predictions of intertidal developments and understanding of the impact of foreshore loss, including the effect on habitats. This is also an important recommendation from the Strategic Environmental Assessment in appendix L.

For PDZ2, the proposed joint plan will have to take full account of the implications for the saline lagoons at Snettisham and for the intertidal habitats seaward of the shingle ridge. Both continuing the current approach and any change in approach are likely to have both positive and negative effects on wildlife. The resulting plan will have to comply with the requirements from the Habitats Regulations.

For Hunstanton town (PDZ3), the plan to continue to provide erosion protection has no effect on wildlife or geology. For Hunstanton cliffs (PDZ4), the short-term plan protects the geological interest of Hunstanton cliffs by continuing the current No active intervention policy. Over the longer term however, possibly from the middle of the century, the intent to protect the cliff top road and properties (which is to be confirmed) would have a negative effect by limiting the exposure of the cliff face.

The SMP policies may have an impact on the ecological status of the water bodies in and around The Wash as described in the Anglian River Basin Management Plan. The detailed assessment in appendix K shows that the (potential) Hold the line policies on the long term in PDZ2 and PDZ3 could prevent the transitional and coastal water bodies (i.e. The Wash and the main rivers) from improving to achieve their ecological potential due to coastal squeeze. This needs to be taken into account in the monitoring and study that the action plan proposes for the coming years. The potential Managed realignment policies on the other hand could have an impact on the freshwater biology of landward water bodies. Any schemes resulting from the

SMP in the future should consider the ecological mitigation measures identified in the Anglian River Basin Management Plan (such as improvements to fish passage, increasing in-channel morphological diversity, use of soft engineering solutions etc). The SMP's policies pose no significant risk for groundwater status.

The Appropriate Assessment, the Strategic Environmental Assessment and the Water Framework Assessment (Appendices K, L and M) contain a comprehensive assessment of the impact of the plan on environmental features. Section 1.5 explains how these stand-alone documents relate to the SMP.

Landscape

For PDZ1, the plan intends to sustain the current landscape, characterised by flood defences forming a sharp division between the wild intertidal area and the artificial agricultural land. In the medium and long term, localised landward realignments in response to possible loss of foreshore would limit the need for hard engineering works, and thereby limit any adverse effect on the intertidal landscape. The part of the PDZ east of River Great Ouse is part of the Norfolk Coast Area of Outstanding Natural Beauty. This will have to be taken into account in future decisions.

For PDZ2, the proposed joint plan could have a significant effect on the local landscape, which will have to be taken into account in future decisions. The AONB is largely limited to the higher ground in this PDZ, so the plan is unlikely to have a direct effect, but it will have an impact on the setting of the AONB. We intend to work with stakeholders to manage this impact and seek opportunities for enhancement.

For Hunstanton town (PDZ3), the plan sustains the existing seaside town landscape of Hunstanton town. For Hunstanton cliffs (PDZ4), the plan in the short term helps to sustain the characteristic exposed cliff face. The longer term intent to prevent further erosion may have a negative effect on this.

Historic environment

There are 45 locally important archaeological and historical sites within the foreshore of the study area that would not be protected; however, such protection would be unsustainable and inappropriate. Consequently, these sites are likely to be eroded and lost over the life of the SMP.

HTL in all epochs for PDZ1 and PDZ3, and for epoch 1 in PDZ 2, would protect 29 locally important archaeological and historical sites and part of the southern end of Hunstanton Conservation Area from erosion. However, some coastal management measures may disturb (physically or visually) these sites and features due to the very nature of the sites (some are sea defences or form part of sea defence structures), however, the significance of the disturbance in the overall context of the SMP is considered to be low. In addition, this policy would ensure no change to extreme flooding for

Terrington St Clement, Sedgeford, and Heacham Conservation Areas, 26 Listed Buildings, 5 Scheduled Monuments, and around 380 locally important archaeological and historical sites, buildings and features.

NAI for PDZ2 in the 2nd and 3rd epochs may result in possible erosion of up to 17 locally important archaeological and historical sites that are predominantly 20th Century or modern in date. It is anticipated that 127 locally important archaeological and historic sites, along with 5 Listed Buildings, 2 Scheduled Monuments, and Sedgeford and Heacham Conservation Areas that are in the Flood Zone will not experience any noticeable impact as a result of additional extreme coastal flooding.

NAI for PDZ4 would result in the loss of the Grade II Listed Lighthouse in Hunstanton within the 3rd epoch, and put at risk the Grade II Listed St Edmund's Chapel within the 3rd epoch. In addition, part of Hunstanton Conservation Area would become eroded throughout all epochs, as well as up to ten locally important archaeological and historical sites. Up to two nationally important buildings will therefore be lost, which is a significant adverse impact. However, it is accepted by English Heritage that such losses may well occur where natural processes are the primary driver for SMP policy choice and that these potential losses need to be balanced by the definition of appropriate protection or mitigation for such historic assets. These issues have yet to be fully explored and will have to be part of the integrated strategy in the coming years, as identified in the action plan.

The historic landscape character remains unchanged for PDZ1 and PDZ3, and no noticeable change except for local site features is expected. However, historic landscape character features in PDZ4 will be disturbed and lost, particularly the Lighthouse, but also other aspects of the Hunstanton Conservation Area, and possible risk to another Listed Building (St Edmund's Chapel). These losses are expected to have a significant adverse effect on the local character within the surrounding area.

For PDZ2, the potential impact on the features near Snettisham and on World War Two features will have to be part of the considerations in developing the long-term sustainable solution in the coming years, which may require a reactive or proactive programme of survey, monitoring, and recording. For PDZ4, the potential loss of historic assets such as the Lighthouse and St Edmund's Chapel on the cliff top and the impact on the Conservation Area are among the key drivers for the action to incorporate the cliffs into an integrated strategy study.

Amenity and recreation

For PDZ1, the main issue is access to the shoreline and the preservation of the footpaths. These are sustained in the short term. Any changes in management in the medium or long term will have to sustain the access, for example through re-routing, in cooperation with the Highway Authority. This

will also need to link up with the Marine and Coastal Access Act which will develop a footpath around the whole of the English and Welsh coast.

For PDZ2, the potential effects on the beach and its amenity function are a key element of the proposed joint plan.

For Hunstanton town (PDZ3), the plan supports the amenity and recreation function of Hunstanton Promenade and its potential redevelopment.

For Hunstanton cliffs (PDZ4), the continuation of No active intervention may in time lead to the loss of the recreational features on the cliff top. The possible long-term plan to stop erosion may have a negative impact on access to the beach and the cliff.

3.3 Economic viability

The SMP guidance states that “*policy decisions are initially taken upon the appraisal of achievement of objectives, not on an economic appraisal. Economic assessments are only undertaken to provide a check on the viability of the selected preferred policies,*” (p.13, section 2.5). This reflects the overall aim of SMPs to develop shoreline management plans for balanced sustainability. The SMP only needs to do a check on the economic viability of the policies to assess whether a policy is clearly viable, clearly unviable or of marginal viability. Even so, there could be cases where a marginally viable or even unviable policy is selected as the policy. The economic assessment does not aim to develop the economic optimum.

On the other hand, the policies do have to be realistic. This is especially relevant for the policies for the short term. As indicated in section 1.1, implementing SMP policies will require funding, which may be national, local and/ or third-party funding. This section summarises the results of the SMP’s high-level assessment of the economic viability of the selected policies, based on the costs of building and maintaining defences and the benefits that the defences provide by reducing flood and erosion risk. The full assessment is included in appendix H; it is based on available information from flood defence strategies, supplemented by a broad-scale analysis of costs and benefits.

For PDZ1, the benefits will easily outweigh the costs because of the significant advantages of continuing to provide flood defence to the settlements around The Wash and their hinterland. This would be the case for the range of possible futures and related plans that the SMP describes, whether by holding the existing alignment or through localised landward realignment.

For PDZ2, both continuing the existing approach and the ‘wide defence zone’ option as described in section 2.4.1 are calculated to be marginally viable. Appendix H3.2 describes the additional analysis carried out within the SMP

to confirm these findings. This means that the benefits of flood defence are of the same order of magnitude as the costs of building and maintaining the defences. This is one of the factors that have led to the proposal to start the joint development of a long-term plan. The current indications that the caravan site owners and residents would be willing to contribute funding for a Hold the line policy will improve the economic viability of continuing the existing approach.

For Hunstanton town (PDZ3), the plan to hold the line is estimated to be marginally viable. However, this calculation only includes the direct effect on properties and neglects the wider socio-economic benefits of continued protection of the Hunstanton seafront. The seafront and promenade are fundamental for Hunstanton's resort function, which is essential to the economy of Hunstanton and very important for the surrounding area. Tourism accounts for over half of all employment in Hunstanton, and around 1/6th of all tourism spending in West Norfolk takes place in Hunstanton. The importance of the seafront and promenade is highlighted by the role it plays in the July 2008 Masterplan, which has informed the LDF. A range of developments which depend on the existing sea defence is currently being implemented. Based on this, the Hold the line policy is judged to be viable. Appendix H provides more detailed information. The SMP's action plan includes an action to provide a more quantified assessment to confirm this judgement.

For Hunstanton cliffs (PDZ4), the plan to start holding the line at the start of epoch 3 to protect the cliff top road and houses is estimated to be marginally viable. Again, this calculation only includes the direct effect on properties and neglects the wider socio-economic benefits, for example the continued protection of the road or the mitigation and socio-economic costs arising from the loss of the heritage assets on the cliff top.

4 Policy statements

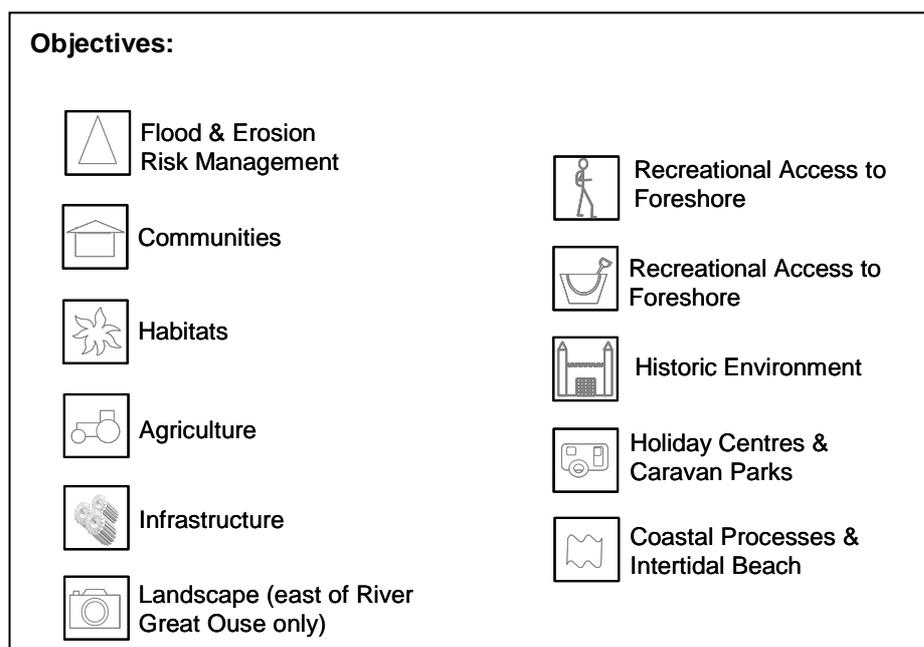
4.1 Introduction

The policy statements in this section outline the policies for each policy development zone. They are illustrated by the policy maps and accompanied by other information that was used to appraise, select and confirm these policies. There is one policy statement per policy development zone, consisting of:

- overall summary of the plan;
- description of the plan in the three epochs;
- summary of the policies;
- description of changes compared to present shoreline management;
- graphical overview of key features and values;
- graphical overview of effects related to the objectives.

The results of the policy appraisal process are illustrated in the policy statements by schematic visualisations. The individual objectives (see text box 2.2, on page 61) were then grouped. A symbol was assigned to each group of objectives (as shown in figure 4.1) and then shaded in green, amber or red to visualise how the policy package performs against it. Note that the 'recreational access' category has been given two separate symbols to represent the different types of recreation that is usually undertaken in the different PDZs. The first symbol represents the walking and birdwatching activities usually undertaken in PDZ1. The bucket and spade represents the beach-centred activities undertaken in PDZs 2, 3 and 4.

Figure 4.1 Icons to illustrate the groups of objectives



4.2 PDZ1 Gibraltar Point to Wolferton Creek

Policy Development Zone:	PDZ1
Location reference:	Gibraltar Point to Wolferton Creek

Summary of the plan: Recommendations and justification

The intent of management for this PDZ is to sustain flood defence for the communities and their hinterland in the low-lying areas around The Wash. This includes an increase of management as needed to sustain the current level of flood risk in the face of climate change.

In the short term the policy to achieve this intent is to hold the existing seabank alignments. In the medium and long term, ideally the existing alignments should continue to be held, but there is a chance that climate change will cause a significant loss of salt marsh and mud flat in front of the seabanks. This would further increase pressure on the defences and affect the integrity of the habitats in The Wash. If this occurs, localised landward realignment needs to be considered as an alternative to holding the line. A realignment would come at the expense of agricultural land directly behind the defences and could require adaptation of drainage infrastructure. However, it would provide more sustainable flood defence for both the people and the high quality agricultural land further inland. It would also support intertidal habitats with associated benefits, such as for fisheries, and provide compensation for intertidal habitat loss caused by coastal squeeze, as required under the Habitats Regulations.

The SMP has identified that more knowledge is needed to confirm the likelihood of this possible loss of foreshore. There is significant uncertainty about the medium- and long-term rate of sea level rise, the increase of storminess, the supply of sediment, the response of the intertidal area to these changes and the role of the flood defences in all this. A decision to either hold the line or realign would have very large consequences on both sides of the current defence line, and these would be difficult to reverse. Against the background that the future needs of society for agricultural land, habitats and other land uses are also uncertain, it would not be appropriate to make a fixed choice for one of the available policy options for the medium and long term at this stage. Therefore, the medium-term and long-term policies are conditional on the results of ongoing monitoring and research. The SMP's action plan therefore contains a specific programme of actions (monitoring, consultation and studies) to improve predictions of intertidal developments and understanding of the effect of foreshore loss on flood defence and habitats.

If monitoring and research show that the current accretional trend is likely to reverse, and that the subsequent loss of foreshore is likely to threaten the integrity of the flood defences and habitats, localised landward realignment will be re-considered and assessed against continuing to hold the existing alignment. In an erosional future, a Hold the line policy is likely to lead to a legal requirement (through the Habitats Regulations) to compensate for the loss of intertidal habitats, and a need to review defence stability and performance. In practice this will be addressed through targeted localised managed realignments within PDZ1, providing a more effective and sustainable sea defence solution by creating a wider foreshore as well as helping to conserve the natural environment.

The SMP is based on the current legal and policy framework. The plan recognises that society may change its priorities in the future, resulting in changes in legislation and Government policy. In addition, the SMP's action plan sets in motion a programme of monitoring and study which will enhance technical knowledge and understanding of the intertidal area. Both these potential changes in society's priorities and the enhanced knowledge could influence the choice of policies. Therefore the policies need to be reviewed through future SMP reviews which happen every five to 10 years or through similar integrated plans.

The increased knowledge to be generated by the SMP initiated programme of monitoring and study will inform the timing, location and extent of any possible localised realignments. They are likely to occur in a stepped process, frontage by frontage as required, not for the whole area at once. The timing, location and extent of the localised realignments will be determined to optimise defence sustainability and to compensate for the expected deterioration of intertidal habitats.

Where a privately-managed front-line earth embankment is backed by a similar earth embankment maintained and supported by the Environment Agency, the SMP's intent concerns the defence system made up of the two lines of sea defence. For the privately-managed front-line, this means in practice that the intent is to allow the private owners and managers to hold the line in epoch 1 (with appropriate consents), which is their current intention. For epochs 2 and 3 the SMP's intent is conditional on how the foreshore develops.

The policy for PDZ1 is compatible with the policy for the neighbouring Gibraltar Point to Skegness frontage (part of the HECAG SMP), which is to sustain flood risk and hold the line, with potential localised managed realignment in the long term. The policy is also compatible with the Catchment Flood Management Plans' policies for management of fluvial flood risk (see section 1.2).

Policy to implement plan:	
From present day (until 2025):	The plan is to hold the defences in their current position and sustain their flood defence function (which includes increased management activity as needed to sustain the existing level of flood risk). In parallel, research is needed into the expected development of the intertidal areas to inform the medium and long term plan. There will be a need to discuss the possible need for localised realignment in the medium and long term.
Medium and long term (2025 to 2105):	It is possible that the current alignment can be held, but it is also possible that localised landward realignment will be needed for part of the frontages around The Wash. If localised realignment is needed, the timing, location and extent will be determined to optimise defence sustainability, to provide time for adaptation, and to compensate for the expected deterioration of intertidal habitats.

Summary of specific policies

Policy Development Zone		Policy plan			Comment
		Now - 2025	2025 - 2055	2055 - 2105	
1	Gibraltar Point to Wolferton Creek	HTL (P4)	HTL or MR (P4)	HTL or MR (P4)	The policies for the medium and long term are conditional. They depend on the results of monitoring and research into climate change, shoreline response and the role of defences.

Key:

HTL – Hold the line; NAI – No active intervention; MR– Managed realignment

Codes in brackets refer to the future intent of flood risk management (see section 2.4.1):

P1: No active intervention;

P2: Reduce existing flood risk management actions, accepting increase of risk over time;

P3: Continue with existing or alternative actions to manage flood risk at the current level, accepting that risk will increase over time from this baseline;

P4: Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from climate change);

P5: Take further action to reduce flood risk.

Changes from present management

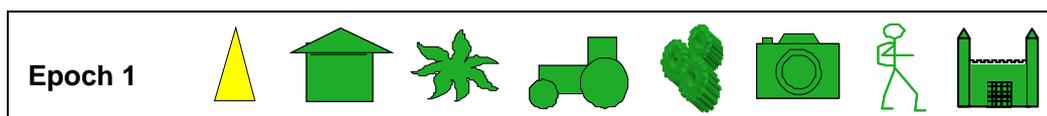
The first round SMP's (SMP1's) policy for the whole PDZ is Hold the line, with the comment that there may be isolated areas for which 'retreat' could be considered. Therefore, in epoch 1 there is no change from the existing policy. The conditional nature of the epoch 2 and 3 policies is different from SMP1, and the actual policy may change, depending on the results of monitoring and research.

Key features and values

The key features and values associated with this PDZ are illustrated in figure 2.9 to figure 2.15.

Policy appraisal results

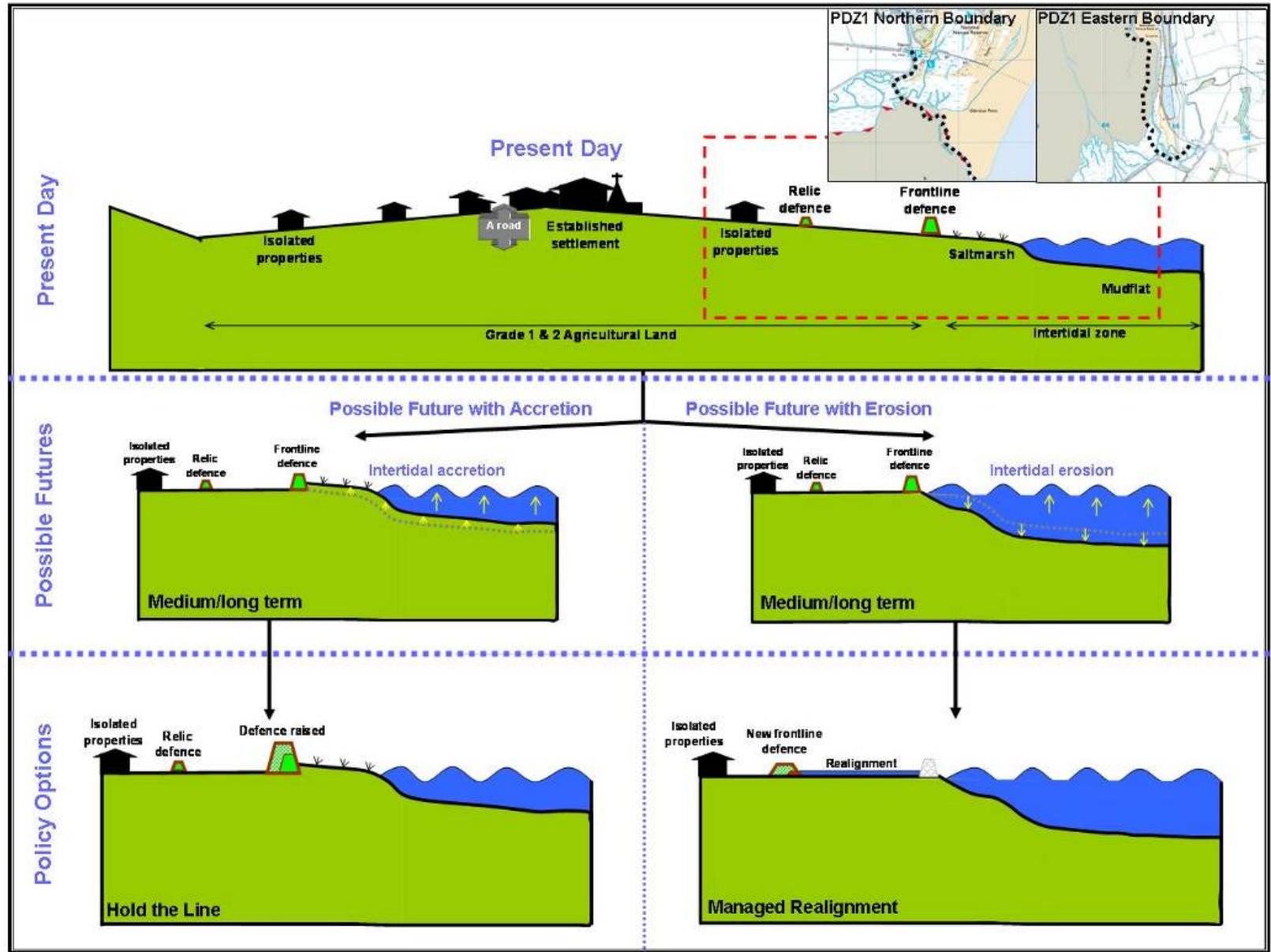
The policy appraisal graphics for PDZ1 are provided below. They only include the appraisal results for epoch 1 as the policies for epochs 2 and 3 cannot be visualised. Appendix E (section E4.2) contains the full results of the policies that have been appraised.



See page 78 for a key to the symbols

Policy mapping

Note: this 'policy map' is different from the other PDZs because it is not possible to visualise PDZ1's conditional plan using a normal map. This map illustrates the plan at a conceptual level.



4.3 PDZ2 – Wolferton Creek to South Hunstanton

Policy Development Zone:	PDZ2
Location reference:	Wolferton Creek to South Hunstanton

Summary of the plan: Recommendations and justification

The intent of management for this PDZ is jointly to develop a sustainable long-term solution by establishing a process of cooperation between the partner organisations and all people and businesses with an interest in the area. This process has already started through a pre-consultation stakeholder meeting on 24 August 2009.

The SMP process has identified that the situation is very complex and sensitive. This is due to the following factors:

- The existing situation is undesirable because there is a significant risk to life. During parts of the year, a large number of people are staying directly behind the defence, which has a relatively low standard of protection (two per cent per year exceedence probability).
- In the future, it will be difficult to sustain even this standard. The shingle ridge needs continuous maintenance to keep providing an appropriate level of flood defence to the holiday homes and caravan parks. Thus far, the costs and the environmental effects of this approach have been acceptable. However, both are expected to increase in the future. It could be difficult to hold the shingle ridge as a flood defence in the long term. Also, it is uncertain whether realignment to the existing seabank is a realistic option. This requires more detailed study.
- The holiday homes and caravan parks are very important for the local and regional economy. To some extent, adaptation may be an option. This could include considering the possibility of relocating some of these facilities out of the flood zone. However, this may reduce their value for tourism, and will certainly require time. Other interests could also be affected, such as the saline lagoons, agricultural land use and historic assets. A sustainable solution can only be developed in close cooperation with all involved. This is why the intent of management for this PDZ is to develop jointly a sustainable long-term solution by establishing a process of cooperation to explore the potential for adaptation, along with other aspects of the situation. This process has already started through a pre-consultation stakeholder meeting on 24 August 2009 with the people and businesses with an interest in the area.

The long-term solution will have to meet the following criteria:

- Risk to life has to be acceptable. This requires an appropriate combination of defence standard, distance of dwellings from the flood defence and emergency management arrangements.
- There will have to be sufficient time for adaptation for the people and businesses that could be affected.

- The solution will have to support Hunstanton in its role as a tourist resort and regional commercial centre. This also includes taking the opportunities that a change in shoreline management may provide.
- The environmental impacts of any changes in shoreline management and the associated changes in land use have to be legally compliant. This concerns the direct impact on the intertidal area seaward of the shingle ridge, but also the longshore impact on Snettisham Scalp and the impact on the saline lagoons in the southern half of this PDZ. A change in shoreline management may also provide opportunities for habitat improvements.
- Any solution to this problem has to be realistically fundable, which is likely to require external contributions from private, public or voluntary organisations or communities. On the basis of the pre-consultation stakeholder meeting on 24 August 2009, there are strong indications that the caravan site owners and residents would be willing to make significant funding contributions to achieve a Hold the line policy.

In the short term, the intent is to hold the existing frontline defences where they are now. This involves both the concrete flood defence / promenade at South Hunstanton and the shingle ridge and earth embankment combination to the south (including the isolated sections of sea wall / revetment). This period up to around 2025 is the minimum time needed to allow the land use adaptation that may be needed. It is essential that the current efforts to manage risk to life are sustained. The costs and the environmental effects are considered acceptable, but this will need to be confirmed by the review of the strategy planned for 2012. This review may identify a need for local or third party funding contributions to achieve the Hold the line policy for the rest of epoch 1; the caravan site owners and residents have indicated they would be willing to contribute to the funding. It is possible that a process of land use adaptation will have to start before 2025.

For the medium and long term, the plan will need to be developed through a partnership approach with all relevant people, businesses and organisations involved, as initiated through the pre-consultation meeting on 24 August 2009. The SMP's action plan sets out these next steps. The best option is likely to be a mixture of flood defences (using existing defences, upgrading old defences or building new defences), incident management and land use changes.

Policy to implement plan:	
From present day (to 2025):	The plan is to hold the defences in their current position. In parallel, there will be a need for all those involved to work together to develop a long-term sustainable shoreline management approach.
Medium and long term (2025 to 2105):	It is possible that parts of the current alignment can be held, but it is also possible that landward realignment or even No active intervention may be required for part of the frontage. The plan, and the timing, location and extent of any changes, will need to achieve the best balance between all the socio-economic and environmental constraints and opportunities. There are strong indications that the caravan site owners and residents would be willing to make significant funding contributions to achieve a Hold the line policy.

Summary of specific policies

Policy Development Zone		Policy plan			Comment
		Now - 2025	2025 - 2055	2055 - 2105	
2	Wolferton Creek to South Hunstant on	HTL	HTL / MR / NAI	HTL / MR / NAI	The policies for the medium and long term are conditional. They will be determined through a collaborative process.

Key:

HTL – Hold the line; NAI – No active intervention; MR– Managed realignment

Changes from present management

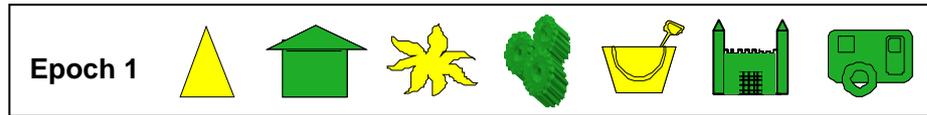
In epoch 1 there is no change from the existing policy. There may be changes into epochs 2 and 3.

Key features and values

The key features and values associated with this PDZ are illustrated in figure 2.17.

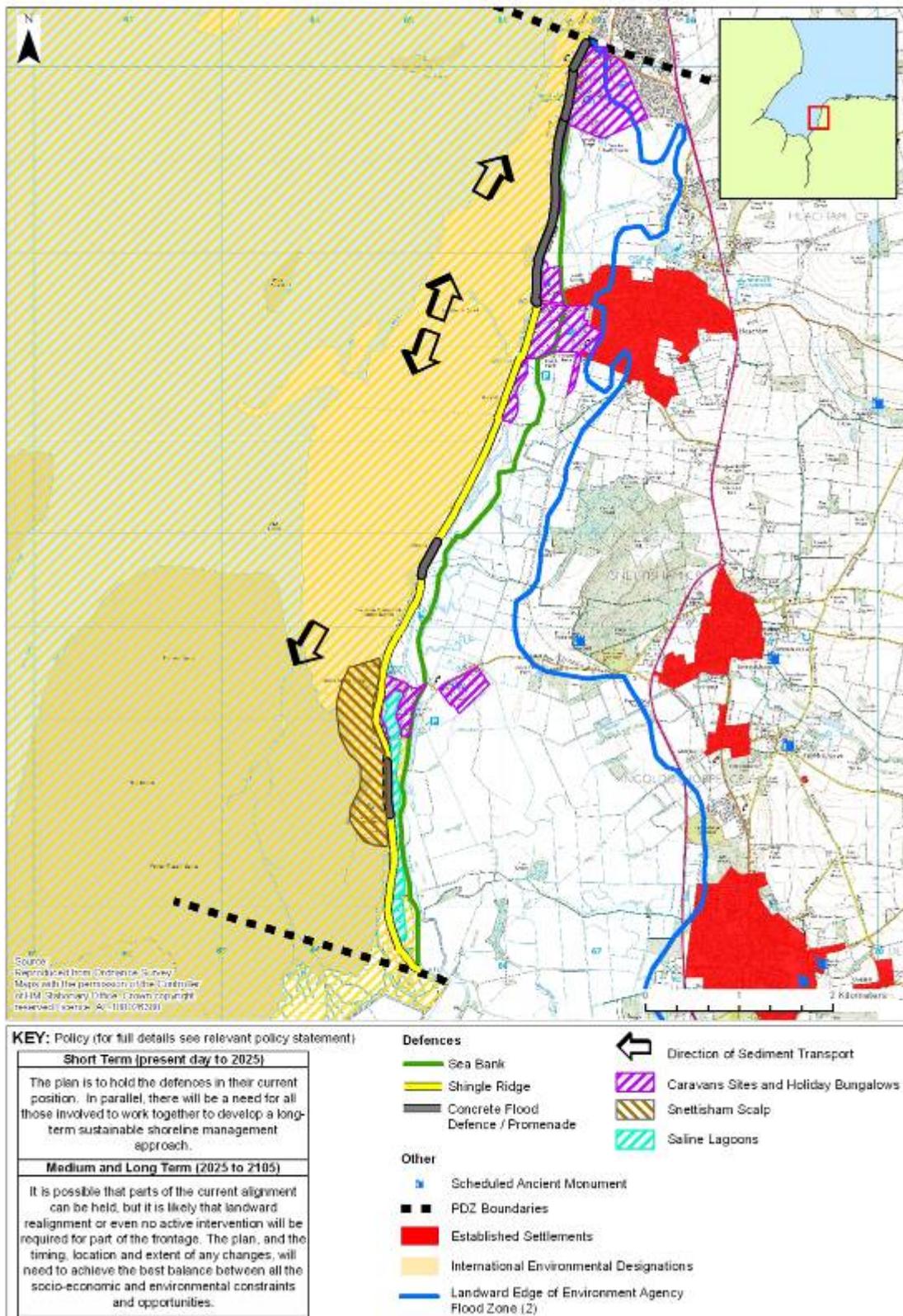
Policy appraisal results

The policy appraisal graphics for PDZ2 are provided below. They only include the appraisal results for epoch 1 as the policies for epochs 2 and 3 cannot be visualised. Appendix E (section E4.2) contains the full results of the policies that have been appraised, and section 3.2 of this document has a textual description of the plan for this PDZ in epochs 2 and 3.



See page 78 for a key to the symbols

Policy mapping



4.4 PDZ3 – Hunstanton Town

Policy Development Zone:	PDZ3
Location reference:	Hunstanton town

Summary of the plan: Recommendations and justification

The intent of management for PDZ3 is to sustain the viability of Hunstanton town as a tourist resort and regional commercial centre. Section 3.3 illustrates that this requires sustaining the promenade and the seafront. Therefore, the intent is to hold the shoreline defences where they are now.

The SMP has identified the need to continue to monitor coastal processes. If this shows that in the longer term Hunstanton may develop into an unsustainable promontory, then the plan will need to be reviewed.

Policy to implement plan:	
From present day (to 2025):	The defences will be held in their current position.
Medium term (2025 to 2055):	The defences will be held in their current position.
Long term (2055 to 2105):	The defences will be held in their current position.

Summary of specific policies

Policy Development Zone		Policy plan			Comment
		Now - 2025	2025 - 2055	2055 - 2105	
3	Hunstanton town	HTL	HTL	HTL	The plan is to hold the current line throughout all epochs; however there will be a need for continued monitoring of the frontage in order to ensure that the town does not develop into an unsustainable promontory.

Key:

HTL – Hold the line; NAI – No active intervention; MR– Managed realignment

Changes from present management

For all three epochs there is no change from the existing policy.

Key features and values

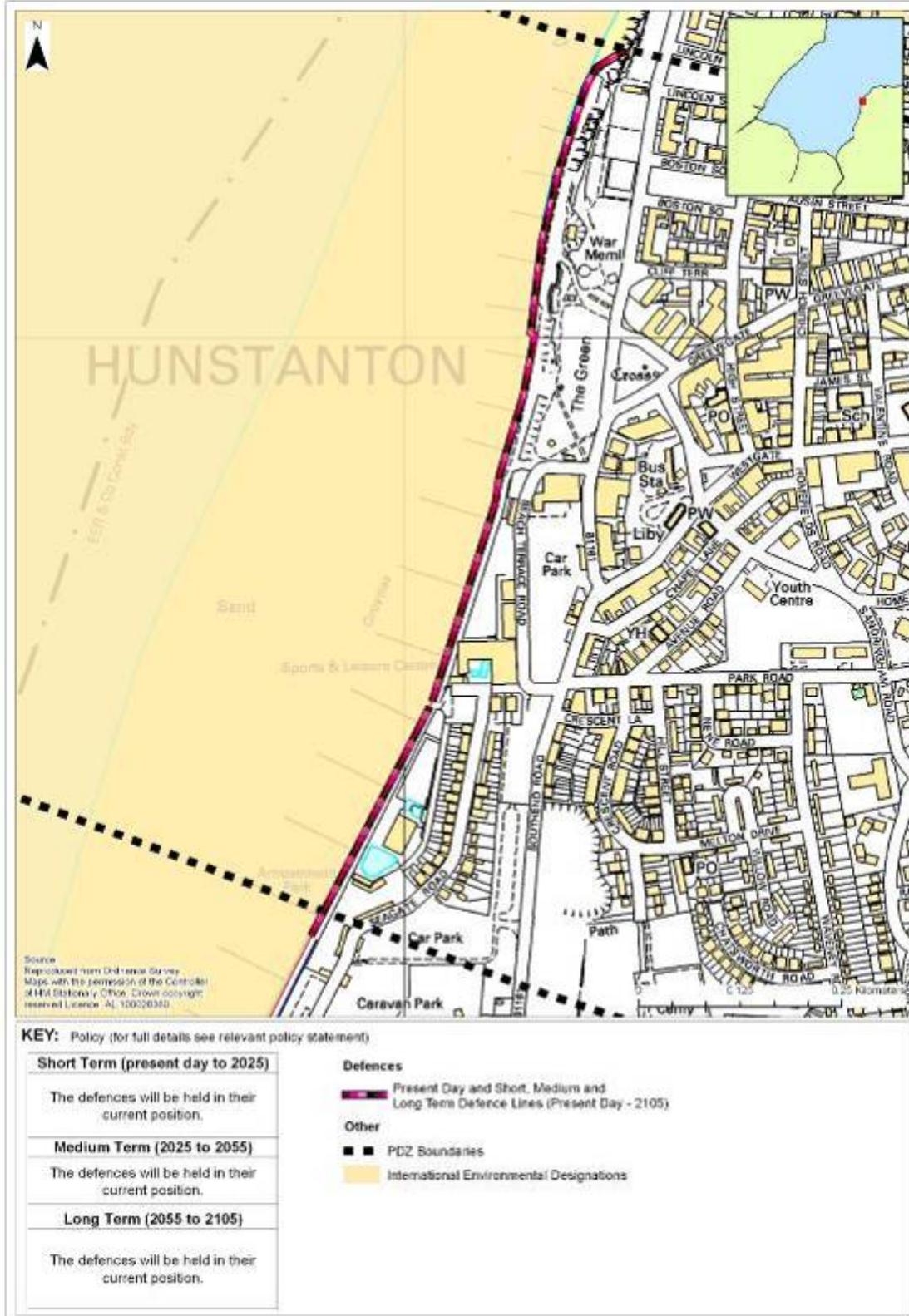
The key features and values associated with this PDZ are illustrated in figure 2.18.

Policy appraisal results

Epoch 1					
Epoch 2					
Epoch 3					

See page 78 for a key to the symbols

Policy mapping



4.5 PDZ4 – Hunstanton Cliffs

Policy Development Zone:	PDZ4
Location reference:	Hunstanton cliffs

Summary of the plan: Recommendations and justification

The intent of management for this PDZ is to continue to allow the cliffs to erode naturally and provide sediment to help maintain the beaches to the south in PDZ3, up to the point where the erosion starts to threaten cliff top properties and the B1161. It is uncertain when this would occur, but based on current knowledge this is likely to occur towards the very beginning of epoch 3 (around the year 2055), although there is a significant degree of uncertainty surrounding this date. From that time on, the intent is to prevent further cliff erosion to sustain the properties and the road.

The continuation of No active intervention on the short and medium term sustains the role of the cliffs as a source of sediment and its geological interest, but it is likely to threaten important historic assets (the lighthouse, St Edmund’s Chapel and the Hunstanton Conservation Area) and the recreational value of the cliff top. In addition, a better understanding of the technical, economic and environmental viability is needed to confirm the long-term intent to protect the properties and the road against erosion.

The SMP has identified the need to carry out an integrated strategy study for the interdependent frontage from Old Hunstanton to Wolferton Creek (PDZs 4, 3 and 2). This will further clarify the role of the cliffs’ erosion as a source of sediment for PDZs 3 and 2 (as discussed in section 2.3.5 and 2.4.1) The associated monitoring, consultation and studies will also improve knowledge of the long-term processes and will support the next round of SMPs, as highlighted in the action plan.

The policy is compatible with the policy for neighbouring Old Hunstanton Dunes (part of the Old Hunstanton to Kelling SMP), which is to maintain the flood defence function of the dune system (see section 1.2).

Policy to implement plan:	
From present day (to 2025):	The cliffs will continue to remain unmanaged.
Medium term (2025 to 2055):	The cliffs will continue to remain unmanaged.
Long term (2055 to 2105):	When cliff erosion starts to threaten cliff top properties and the road (expected around 2055), the intent is to prevent further erosion, subject to technical, economic and environmental sustainability.

Summary of specific policies

Policy Development Zone		Policy plan			Comment
		Now - 2025	2025 - 2055	2055 - 2105	
4	Hunstanton cliffs	NAI	NAI	NAI / HTL	For epoch 3 the intent is to sustain cliff top features, but it is uncertain whether this requires intervention, and whether this intent can be implemented in a sustainable manner.

Key:

HTL – Hold the line; NAI – No active intervention; MR– Managed realignment

Changes from present management

In epochs 1 and 2 there is no change from the existing policy. Into epoch 3 there is the potential that there will be a change from the SMP1 policy. The medium-/ long-term policy from SMP1 is described as “Retreat the Existing Defence Line”, which involves the “construction of defences at the toe of the cliff to reduce the rate of erosion while maintaining the geological interest”. This could be different to the long-term policy as put forward by this plan as it implies that the cliff top properties will still be at risk of erosion.

Key features and values

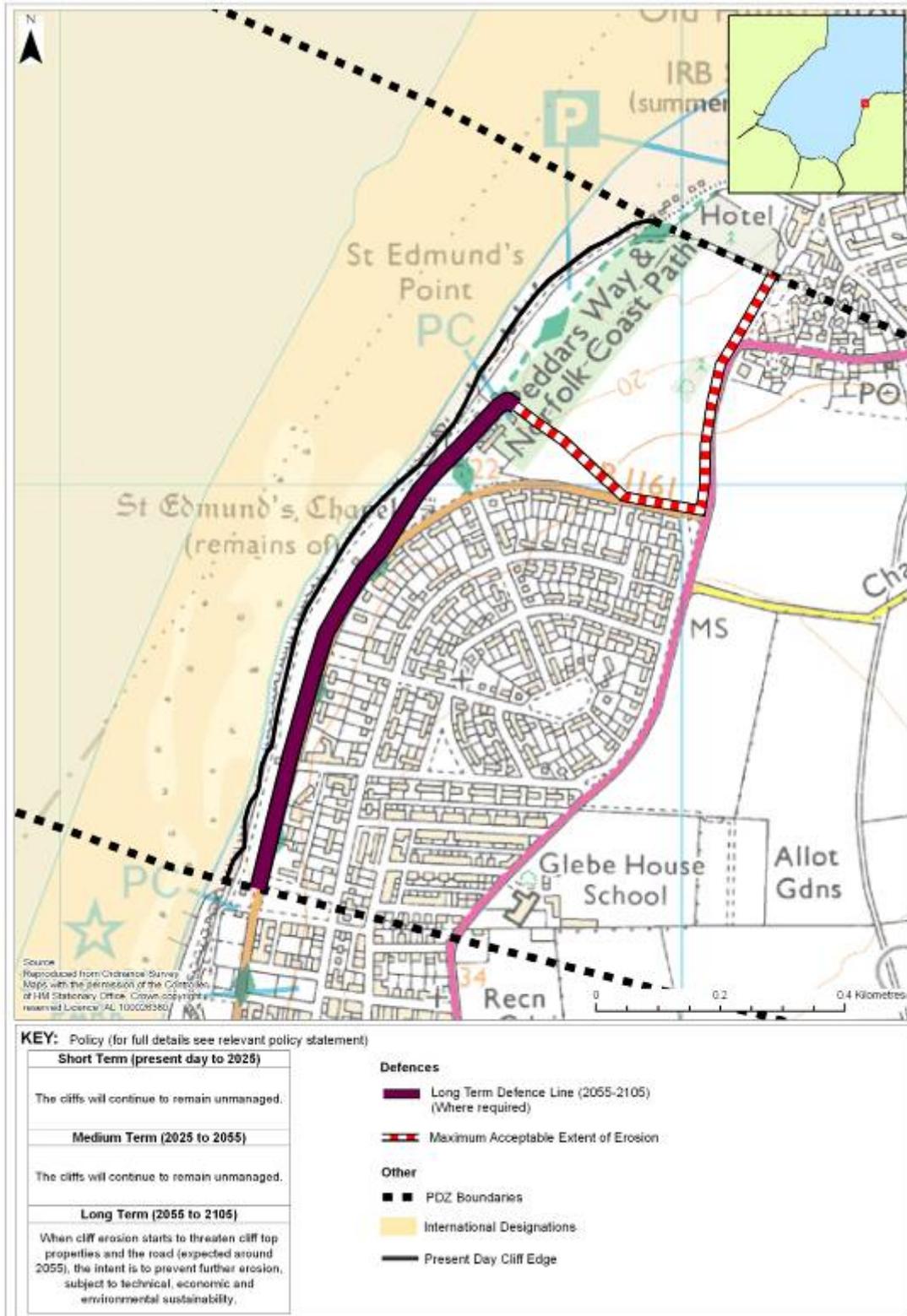
The key features and values associated with this PDZ are illustrated in figure 2.19.

Policy appraisal results

Epoch 1					
Epoch 2					
Epoch 3					

See page 78 for a key to the symbols

Policy mapping



4.6 Summary

Policy Development Zone	Epoch 1 (present day – 2025)	Epoch 2 (2025 – 2055)	Epoch 3 (2055 – 2105)
1 (Gibraltar Point to Wolferton Creek)	HTL (P4)	HTL or MR (P4)	HTL or MR (P4)
2 (Wolferton Creek to South Hunstanton)	HTL	HTL / MR / NAI	HTL / MR / NAI
3 (Hunstanton Town)	HTL	HTL	HTL
4 (Hunstanton Cliffs)	NAI	NAI	NAI / HTL

5 Action plan

This section includes the action plan for The Wash SMP.

This action plan is a very important element of the SMP, and particularly for The Wash SMP. The plan has identified that there are a number of important uncertainties, and that we need to improve our understanding to support firmer policy decisions in the next generation SMP and beyond.

The intent is to continue the partnership approach that has led to the development of this SMP, at the level of elected members, officers and stakeholders, to be linked with the existing Coastal Group. By organising regular progress meetings, this ongoing partnership can actively monitor and drive the progress of the action plan. This will enable an ongoing process of shoreline management in the coming years, in the run-up to the next generation SMP in five to ten years time.

The partner organisations that developed this SMP intend to do their utmost to secure the necessary funding and resource to implement the actions and deliver the plan.

The action plan summarises all the specific actions that are needed to implement the plan and the policies. This includes actions by the Environment Agency and local authorities to develop flood and erosion defence strategies and schemes. It also includes actions on the other partner authorities, for example to incorporate the plan into the land use planning system or support adaptation of affected people, businesses and organisations. A specific element for The Wash SMP action plan concerns the monitoring and study needed to reduce uncertainty about future foreshore development in PDZ1 which is needed to decide the policy for the medium and long term.

The action plan is set up in five tables: first the actions that concern the whole of the SMP area, then a table for each of the four PDZs. The action plan has also been developed in an Access Database, for use as a living document in the coming years.

SMP wide actions

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ¹
0.1	Implementation of SMP policies and actions through continuation of periodic CSG and EMF meetings. This will ensure formal tracking of the SMP's Action Plan and will also be essential in ensuring that findings of specific studies / monitoring is communicated back to key stakeholders.	Environment Agency* with all partners	High	2010	2010		O
0.2	Continue consultation with key stakeholders and general public in the period up to SMP3 (progress of action plan; conveying messages around flood and erosion risk, potential coastal change).	Environment Agency* with all partners	High	2010	2010		O
0.3	Ensure that local and regional development planning documents take account of SMP policies and flood and erosion risks	Planning authorities* and Environment Agency	High	2010	2010		O
0.4	Development, monitoring and review of emergency response plans to prepare for extreme events that exceed standard.	Local authorities* and Environment Agency	Medium	2010	2010		O

¹ N = not yet commenced, O = ongoing, C = complete.

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ¹
0.5	Continue with improvements to flood risk maps and inundation modelling to provide improved flood warning service.	Environment Agency*	Medium	2010	2010		O
0.6	Wash SMP3 There may be a case for promoting an integrated Flood Risk Management plan (coastal and fluvial), combining the SMP with the CFMPs.	Environment Agency* with all partners	High	2015 - 2020			N
0.7	Ensure that the SMP policies and their implementation comply with the forthcoming Flood and Water Management Act and the Flood Risk Regulations (2009).	Environment Agency* and all partners	High	2010 - 2011			N

PDZ1 Gibraltar Point to Wolferton Creek

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ²
Actions required for short-term policy							
1.1	Continued management of defences, including training walls. Production of System Asset Management Plans to deliver HtL P4 policy for epoch 1. Maintenance and refurbishment as required.	Environment Agency*	High	2010	2010		O
1.2	Liaison with private landowners at locations where the frontline earth embankment is private (and is backed by an Environment Agency managed earth embankment) to enable the defence to be maintained in epoch 1	Environment Agency* and private landowners	High	2010			N
Studies / strategies required to inform intended medium-term management policies							
1.3	Study to reduce uncertainty with respect to the predictions of saltmarsh / mudflat development and to enable predictions of saltmarsh and mudflat loss / gain to be more accurate. This will be informed by monitoring (see Action 1.12).	Environment Agency*, Natural England, other partners	High	2011; to inform SMP3			N

² N = not yet commenced, O = ongoing, C = complete.

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ²
1.4	Update of agricultural land grade classification	Defra*	Medium	2012; to inform SMP3			N
1.5	High level study to clarify the importance of agricultural land for food security in relation to habitat requirements.	Defra*, NFU	High	2012; to inform SMP3			N
1.6	Integrated flood risk management strategy (coastal and fluvial) for the Fens. This may be replaced by an integrated SMP / CFMP level Flood Risk Management Plan.	Environment Agency*	Medium	2012			N
1.7	Strategic study into potential sites for localised realignment for epochs 2 / 3, including technical (defence sustainability), economic, social, environmental, and historic environment aspects	Environment Agency*	Medium	2011; to inform SMP3			N
1.8	Upgrade / update of Rapid Coastal Zone Assessment Survey (RCZAS) for Norfolk	English Heritage*, Norfolk Landscape Archaeology	Medium	2011; to inform SMP3			N

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ²
1.9	Policy study to determine role and management of secondary defences. This will require joint working, involving the Environment Agency, Local Authority planners and IDBs. The aim will be to determine their completeness and condition, their impact and desired role, to inform flood risk management and land use planning. There will also need to be a review of the legal process to establish the secondary defences as formal defences. This may be included in the integrated Fens flood risk management strategy (action 1.6).	Environment Agency* / Local Authorities / Internal Drainage Boards. (Note: action lead could also be the County, based on new powers from F&WM Act)	Medium	2012			N
1.10	Study to assess the impact of the medium- and long-term policies on the fisheries operating within The Wash. This will be informed by monitoring, see Action 1.12.	Environment Agency* and partners	Medium	2012; to inform SMP3			N
1.11	Study to reduce uncertainty with respect to the predictions of offshore bank development. This will be informed by monitoring, see Action 1.12.	Natural England*, Environment Agency	Medium	2012; to inform SMP3			N

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ²
Monitoring required to inform medium-term policy studies							
1.12	Continue / increase monitoring of saltmarsh and mudflat areas. This needs to inform understanding of the intertidal areas' flood defence function, the sustainability of the earth embankments, and its habitat function. To be integrated with Strategic Regional Shoreline Monitoring Programme. This Programme should also aim to collate information relating to dredging (locations, timings, volumes etc.) within The Wash.	Environment Agency*, Natural England, other partners. There may be a coordinating role for The Wash & North Norfolk Coast European Marine site management scheme	High	2010; to inform SMP3	2010		O
1.13	Monitoring to ensure that the intertidal development trends are consistent with assumption made in the SMP. This will be aided by the ongoing monitoring as detailed in Action 1.12.	Environment Agency*	High	2011; to inform SMP3			N

PDZ2 Wolferton Creek to South Hunstanton

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ³
Actions required for short-term policy							
2.1	Develop collaborative approach to achieve hold the line policy (for both shingle ridge and earth embankment) for epoch 1. This will be crucial for the review of the current strategy in 2012 (see Action 2.2).	Environment Agency*, King's Lynn and West Norfolk BC, Norfolk CC, caravan site owners, residents and landowners	High	2009	2009		O
2.2	Carry out the planned review of the Hunstanton - Heacham flood defence strategy. There needs to be a close link with Action 2.1.	Environment Agency*	High	2010			N
2.3	Continued management of defences. Production of System Asset Management Plans. Maintenance and refurbishment as required.	Environment Agency*	High	2010	2010		O

³ N = not yet commenced, O = ongoing, C = complete.

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ³
Studies / strategies required to inform intended medium-term management policies							
2.4	Continue the collaborative approach started in Action 2.1 to develop a strategy for the management of the defences in epochs 2 and 3. The plan, and the timing, location and extent of any changes, will need to achieve the best balance between all the socio-economic, environmental and historic environment constraints and opportunities.	Environment Agency*, King's Lynn and West Norfolk BC, Norfolk CC, Norfolk Landscape Archaeology, caravan site owners, residents and landowners	High	2010; to inform SMP3	2010		O
2.5	Incorporate any changes in land use planning.	King's Lynn and West Norfolk BC*	High	2010			N
2.6	Upgrade / update of Rapid Coastal Zone Assessment Survey (RCZAS) for Norfolk; see action 1.8	English Heritage*, Norfolk Landscape Archaeology	Medium	2011; to inform SMP3			N

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ³
Monitoring required to inform medium-term policy studies							
2.7	Continuation of Strategic Regional Shoreline Monitoring Programme, see action 1.12. This Programme should also aim to collate information relating to dredging (locations, timings, volumes etc.) within The Wash.	Environment Agency*, Natural England, other partners. There may be a coordinating role for The Wash & North Norfolk Coast European Marine site management scheme	High	2010	2010		O
2.8	Monitoring to ensure that the Snettisham Scalp spit and shingle ridge development trends are consistent with assumptions made in the SMP. This will be aided by ongoing monitoring as detailed in Action 2.7.	Environment Agency* with collaboration with Natural England and RSPB	High	2010			N

PDZ3 Hunstanton Town

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ⁴
Actions required for short-term policy							
3.1	Continued management of defences.	King's Lynn and West Norfolk BC*	High	2010	2010		O
Studies / strategies required to inform intended medium-term management policies							
3.2	Study into confirming the economic viability of maintaining the coastal defences at Hunstanton. This study would include an assessment of the wider benefits of the defences to Hunstanton's seafront and gain understanding on the impact of the listed buildings and conservation area. May be combined with Action 2.2.	King's Lynn and West Norfolk BC*, Environment Agency	High	2011; to inform SMP3			N
3.3	Condition assessment of Hunstanton Town defences, as part of / feeding into action 3.2.	King's Lynn and West Norfolk BC*	High	2011; to inform SMP3			N

⁴ N = not yet commenced, O = ongoing, C = complete.

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ⁴
3.4	Study into possible mitigation of lowering beach levels along the Hunstanton Town frontage. This will be informed by monitoring, see action 3.7. Could be combined with Action 2.2.	King's Lynn and West Norfolk BC*, Environment Agency	Low (only required if EA monitoring shows lowering trend)	2013; to inform SMP3			N
3.5	Upgrade / update of Rapid Coastal Zone Assessment Survey (RCZAS) for Norfolk; see action 1.8.	English Heritage*, Norfolk Landscape Archaeology	Medium	2011; to inform SMP3			N

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ⁴
Monitoring required to inform medium-term policy studies							
3.6	Continuation of Strategic Regional Shoreline Monitoring Programme, see action 1.12. This Programme should also aim to collate information relating to dredging (locations, timings, volumes etc.) within The Wash.	Environment Agency*, Natural England, other partners. There may be a coordinating role for The Wash & North Norfolk Coast European Marine site management scheme	High	2010	2010		O

PDZ4 Hunstanton Cliffs

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ⁵
Actions required for short-term policy							
No actions have currently been identified for PDZ4							
Studies / strategies required to inform intended medium-term management policies							
4.1	Study to determine the feasibility of defending the Hunstanton Cliffs on the long term. This should look into the technical feasibility, in terms of options available and impacts on the coastal processes, and therefore impacts on adjacent PDZs (PDZ3 and PDZ2), economic feasibility, environmental feasibility (impacts of protecting the cliffs on the geological designation) and the values on top of the cliffs (amenity and historic environment). May be combined with Action 2.2.	King's Lynn and West Norfolk BC*, Environment Agency, Natural England, English Heritage, Norfolk Landscape Archaeology, Norfolk CC and Stakeholders (including residents, property owners, businesses, Civic Society, Town Council)	High	2011; to inform SMP3			N

⁵ N = not yet commenced, O = ongoing, C = complete.

Action ref	Works required	Responsibility (* marks lead)	Priority	Target start date	Actual start date	Completion date	Action status (N/O/C) ⁵
4.2	Upgrade / update of Rapid Coastal Zone Assessment Survey (RCZAS) for Norfolk; see action 1.8.	English Heritage*, Norfolk Landscape Archaeology	Medium	2011; to inform SMP3			N
Monitoring required to inform medium-term policy studies							
4.3	Continuation of Strategic Regional Shoreline Monitoring Programme, see action 1.12. This Programme should also aim to collate information relating to dredging (locations, timings, volumes etc.) within The Wash.	Environment Agency*, Natural England, other partners. There may be a coordinating role for The Wash & North Norfolk Coast European Marine site management scheme	High	2010	2010		O
4.4	Continued long-term background monitoring of erosion of the cliffs	King's Lynn and West Norfolk Borough Council*	High	2010	2010		O

6 Appendices

Appendix A SMP development

- Describe stages and tasks.
- Includes references to main text and other appendices for content.
- Includes graphics / diagrams shown in CSG / EMF presentations to explain logic of the SMP tasks.

Appendix B Stakeholder involvement

- Based on stakeholder engagement strategy.
- Includes information about all meetings and public events that have taken place so far
- Summary of public consultation on draft SMP

Appendix C Baseline processes

- Final report looking at coastal processes and evolution.

Appendix D Thematic review

- Final report defining features, benefits and issues.

Appendix E Policy development and appraisal

- Description of the policy development and appraisal process.
- Objective-setting, including description of the agreed approach, characterisation, objectives for each frontage and accompanying key value graphics.
- Policy development, including:
 - playing field
 - definition of policy packages (PPs) (including defining the options for appraisal and defining the alignment of the policy packages).
- Policy appraisal (including additional task of testing the baseline scenarios which helped to shape the policy appraisal method). This will include the full policy appraisal results in tabular form for one PP for one PDZ, and will present the complete set of policy appraisal graphics for all PPs for all PDZs.
- From policy appraisal to policy – describes the steps we went through for PDZ1 and PDZ2 in terms of additional work, modelling, sensitivity analysis, and the way forward from this additional work.
- Summary of changes since public consultation

Appendix F Shoreline interactions and responses

- Final report prepared for assessment of coastal defences task.
- Final report prepared for develop baseline scenarios task.
- Final report prepared for assess shoreline response task (under all PPs for all PDZs).

- From policy appraisal to policy – mirrors the same chapter as in appendix E – discusses the additional work in more detail and focuses on the coastal processes elements of the additional work.

Appendix G Policy appraisal

- Focuses only on the selected plan.
- Provides final alignments and shoreline response figures for the plan for each PDZ, and the final policy appraisal graphics.
- Focuses more on the justification and less on the description of the policy.

Appendix H Economics

- Final report prepared for socio-economic assessment task.
- Provides high-level assessment of the economic justification of the policy in terms of justified, not justified and marginal.

Appendix I Metadatabase and bibliographic database

- Description and tables - refers to digital deliverables.

Appendix J Sustainability appraisal signposting

- Contains 'roadmap' produced for how the SMP covers the requirements of the sustainability appraisal.

Appendix K Water Framework Directive assessment

- Assessment of the plan and policies against the objectives from the River Basin Management Plan.

Appendix L Strategic Environmental Assessment

- Contains the structured evaluation of the plan against an established suite of environmental and socio-economic receptors.

Appendix M Appropriate Assessment

- Contains the assessment of the plan for its potential impacts on international wildlife designations in line with the Habitats Regulations.