Coastal Management Theme Plan

Developing a strategic and adaptive approach for flood and coastal erosion risk management for England's Natura 2000 sites

'Improvement Programme for England's Natura 2000 Sites – Planning for the Future'

www.gov.uk/government/publications/improvement-programme-for-englands-natura-2000-sites-ipens

Preface

IPENS and theme plans

The Improvement Programme for England's Natura 2000 sites (IPENS), supported by European LIFE+ funding, is enabling Natural England, the Environment Agency, and other key partners to plan what, how, where and when to target their efforts on Natura 2000 sites and the areas surrounding them. As part of the IPENS programme, themed action plans are being developed. 'Theme plans' are high-level plans which aim to improve the way in which a key issue for the Natura 2000 network is managed. Theme plans can provide an over-arching direction, recommendations or outline approaches to achieve target conservation status of Natura 2000 sites in England, to complement work already underway on individual sites. The plans do not have a legal or political status and do not constitute a systematic evidence review. They are to inform action and initiatives of Natural England and its partners to help achieve the objectives of Natura 2000.

It is anticipated that Natural England and others, working with stakeholder and partners, will all play a role in implementing the theme plan. In the process of developing the theme plans Natural England has approached key partners and delivery bodies to seek input and agreement on the roles in delivering the improvements, although in some cases these discussions have not yet been concluded. Recommended actions and next steps identified in the theme plans are not necessarily committed or resourced but aimed at informing future resource decisions. Implementation of the theme plan recommendations will be via local prioritised delivery plans and coordinated through the IPENS After-Life Steering group, working with national and local delivery partner organisations.

Audience

The Coastal Management theme plan is about the inter-relationship between management of designated conservation sites and the features they support, and flood and coastal erosion risk management. There are two main audiences, firstly those looking for a strategic overview of Natural England's approach to coastal sites in terms of conservation, and secondly Natural England's delivery staff who will play a key role in working with others to take forward the actions required on coastal sites as identified in the Site Improvement Plans (SIPs).

General aspects of the strategic approach recommended and the priority actions identified may also be of interest to managers, Defra, the Environment Agency and colleagues in the other UK conservation agencies, as well as those involved in Integrated Coastal Zone Management (ICZM). There are many synergies between flood and erosion risk management and other elements of coastal management, such as recreation, access, landscape, tourism and pollution, but these are not covered in this theme plan. People reading this plan, may be interested in other Theme Plans which have a link with this one and a list of all theme plans can be found in Annex 3.

Because flood risk management underpins the action needed to address inappropriate coastal management or coastal squeeze, partnership working is essential. This theme plan aims to be a useful tool for building on existing engagement at both a national and local level between Natural England, the Environment Agency and Defra, and other partners. Further discussion around the issues raised in this theme plan with other organisations, especially the Environment Agency and Defra Flood Risk Management is welcomed, as it is recognised that this theme plan is one piece of the complex system of work going on in flood and coastal risk management, not just on Natura 2000 sites, but in the context of wider coastal management.

Executive summary

This document is the theme plan for coastal management produced by the Improvement Programme for England's Natura 2000 sites (IPENS). It describes the importance of adaptive coastal management to the achievement of objectives set by the EC Habitats & Birds Directive and presents an overview of Natural England's recommended approach to address challenges faced by coastal Natura 2000 (N2K) sites.

Recommended Actions

A strategic approach to coastal management within Natura 2000 sites is very complex and requires partnership working with other statutory bodies, key involved organisations, land owners and stakeholders. A series of priority actions are outlined that address three key areas of the approach:

a) Strategic actions, including a holistic approach to habitat creation; looking beyond managed realignment to more innovative approaches; and, embedding the need to allow for natural and managed coastal change into planning and strategic land use plans. (Note coastal access is examined more thoroughly in the Recreation & Disturbance theme plan, but implementation must take full account of coastal change);

b) Policy recommendations, including 'no active intervention' approaches in specific locations, together with greater emphasis on working with natural processes and adapting to climate change;

c) Site level actions, including improving the evidence base; better partnership working; freshwater habitat creation away from saline flood risk areas; and, delivery of flood and erosion risk management that helps achieve conservation objectives

Contents

1. General Background

The Natura 2000 network in England has 52 SACs with coastal and intertidal habitat features and 46 SPAs with coastal supporting habitats or in the coastal zone. There is considerable spatial overlap between these designations. In short, there is an important suite of Natura 2000 sites at the coast that support internationally important habitats and species. The 2013 Article 17 reporting on the conservation status of these habitats, (JNCC 2013a) and the 10th UK report for Article 12 of the Birds Directive (JNCC 2013b) highlights a number of pressures and threats linked to climate change and sea level rise, particularly where human activities impact on the natural function of coastal processes. For most intertidal Annex I habitats in England, the overall conclusion on their conservation status was reported in 2013 as 'bad-deteriorating'[1].

Table 1: List of Natura 2000 Annex I habitats relevant to the theme plan and their UK conservation status (3rd UK Habitats Directive report http://jncc.defra.gov.uk/page-6565). The conservation status assessments relate to habitat occurrences inside as well as outside Natura 2000 sites. The trend of the habitat area within the Natura 2000 network is also indicated where known.

Code	Habitat name	Habitat Area	Structure & function	Area trend in UK N2k
H1130	Estuaries	Unknown	Bad	Unknown
H1140	Mudflats and sandflats not covered by seawater at all times	Unknown	Bad	Unknown
H1150	Coastal lagoons	Favourable	Inadequate	Stable
H1210	Annual vegetation of drift lines	Inadequate	Bad	Decrease
H1220	Perennial vegetation of stony banks	Inadequate	Bad	Decrease
H1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	Inadequate	Bad	Stable
H1310	Salicornia and other annuals colonising mud and sand	Inadequate	Bad	Decrease
H1320	Spartina swards (*Spartinion maritimae*)	Bad	Bad	Decrease
H1420	Mediterranean and thermo-Atlantic halophilus scrubs (Sarcocornetea fruticosa	Inadequate	Bad	Stable
H2110	Embryonic shifting dunes	Inadequate	Bad	Decrease
H2120	Shifting dunes along the shoreline with Ammophila arenaria (`white dunes`)	Inadequate	Bad	Decrease
H2130	Fixed dunes with herbaceous vegetation (`grey dunes`)	Inadequate	Bad	Stable
H2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	Favourable	Bad	Decrease
H2160	Dunes with Hippophae rhamnoides	Favourable	Bad	Stable
H2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	Inadequate	Bad	Decrease
H2190	Humid dune slacks	Inadequate	Bad	Decrease
H1160	Large Shallow inlets and bays	Favourable	Bad	Stable
H1330	Atlantic salt meadows	Inadequate	Bad	Decrease

The 2013 Habitats and Birds Directive assessments indicated pressures and threats to species and habitats, and identified generic measures needed to address these, including coastal habitat restoration to counter the effects of sea level rise.

The coastal environment is driven by energy from tides, waves, wind and currents. This energy allows sediment movement, flooding, accretion and erosion. Coastal ecosystems are dependent on these processes and they will also respond to sea level rise. Along with other physical, hydrological and chemical factors, these enable species to colonise sand and mud, which can develop into more complex biological communities over time and space as more sediment accumulates. In unmodified systems there are cycles of change in response to natural events like storms or landslides, or long-term changes such as land sinking (isostatic change), Flooding and erosion (and sometimes accretion) are also factors that humans have tried to manage or prevent to protect people, property and economic activities in the coastal zone. This is generally termed 'coastal risk management'. The last decade has seen more

[1] For an explanation of these terms see JNCC 2013c. http://jncc.defra.gov.uk/page-6392 and also https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/252472/2b._Priority_habitats_FINAL.pdf

integrated approaches between coastal risk management and the natural environment, with increased understanding of how coastal ecosystems function, and how these processes contribute to risk management. It is now recognised that there needs to be more consideration of how coastal management interacts with, and depends on, the natural environment and how the coast is changing in response to sea level rise and climate change (European Commission 2002, 2004, Defra 2008).

The implications of coastal risk management, including environmental impacts have been increasingly recognised over recent years, and have developed into the current policy and practice as set out in the National Flood and Erosion Risk Management Strategy[2]. The introduction of strategic approaches through the current Shoreline Management Plans (SMPs) has led to a greater emphasis on long-term planning and equal consideration of technical, economic and environmental aspects. Shoreline Management Plans are informed by a range of information[3], and set the direction for how coastal flooding and erosion risk is managed. They take account of environmental interests, but are followed by more detailed studies to decide on the individual schemes.

Environmental aspects of coastal risk management are complex. Some habitats and species depend on the presence of flood defences to prevent sea flooding, others rely on the active processes in the coastal zone. Sea level rise combined with land falling and reduction in sediment availability adds the problem of intertidal habitats changing. To explore these issues, including how to use the available evidence, a LIFE-funded project partnership project '*Living with the Sea*', ran from 1999 to 2003. This introduced the concept of Coastal Habitat Management Plans (CHaMPs) for Natura 2000 complexes to inform strategic flood risk management strategies that would meet the requirements of the Habitats Directive. These would apply evidence and understanding about geomorphological and ecological processes at a large scale, taking account of future and past coastal change, to predict losses and gains of designated features over 30-100 year timescales. Six pilot CHaMPs produced as part of the project evaluated the implications of flood and coastal defence policies on environmental interests, In short, these plans provided advice where maintaining sea defences would affect Natura 2000 designated features in the short and long term and an indication of measures to offset any impacts, primarily by habitat creation. The project engaged widely with local landowners, communities and public bodies to develop, discuss and consider the longer-term changes and how these could be managed.

These pilot CHaMPs and others produced later were used to inform the second-generation of SMPs[4], largely completed by 2011. Where these included Natura 2000 sites, these plans were assessed according to the requirements of the Habitats Regulations. If this assessment concluded that there would be impacts from flood and coastal erosion risk management (FCERM) actions on Natura 2000 features, and that there was an over-riding need for that, compensatory measures to maintain the Natura network would be needed. This would mainly be through habitat creation. The use of Regional Habitat Creation Plans led by the Environment Agency enable a strategic approach to habitat creation so it would be in place before the predicted changes. In 2011, the European Commission confirmed that this strategic approach, including the creation of new habitats in advance of loss as a result of FCERM activities, met the requirements of the Habitats Directive. This approval also noted that the need to carry out appraisals for the more detailed strategies and individual schemes as they were put into place during the period of the plan.

[2] https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england
[3] https://www.gov.uk/government/publications/shoreline-management-plans-guidance
[4] https://www.gov.uk/government/publications/shoreline-management-plans-smps/shoreline-management-plans-smps

2. Definitions and terminology

It is important to understand the terminology agreed between Natural England and the Environment Agency used to consider coastal management issues on designated sites and when giving advice on conservation objectives. The two terms that are important are: 'Inappropriate coastal management' and 'coastal squeeze', both relating to the management of flood and erosion risk on protected sites.

There may be other factors causing problems such as grazing, pollution, water abstraction, which are dealt with as separate issues.

To avoid confusion with other potential definitions, these two terms as used in protected site reporting and advice are set out in more detail below.

2.1 Inappropriate coastal (risk) management:

In the context of this Theme Plan, the term relates to activities and structures that reduce the risk of flooding or erosion to people, property and the environment. It includes a range of existing operations and/or engineering works for flood and erosion risk management which lead to direct or indirect damage to the nature conservation feature or alteration of coastal processes on which features depend. It doesn't include habitat management or recreational management. It can apply to both open coast and estuarine sites and to a range of coastal habitat types. The activity or structure, such as a sea wall, may have been in place before designation, but may still be causing problems for the site features. The impacts are generally deterioration or damage to habitats particularly caused by interrupting coastal sediment processes. Maintaining, rebuilding or continuation of operations and structures may need renewal of consents or permissions. Some examples of these are listed in Annex 2.

2.2 Coastal Squeeze

Coastal squeeze is a subset of inappropriate coastal (risk) management and in the context of this Theme Plan is defined in the following way:

Sites largely (but not exclusively) within estuaries where migration of the interest features/Annex I habitats in response to sea level rise and other coastal processes are prevented by a fixed sea wall or other man-made structures which is being maintained. These structures were constructed to cut off intertidal land from the sea in order to convert it for agriculture or development. The original coastal flood plain has therefore been reduced in size. This results in the intertidal habitats being trapped between rising sea levels and a fixed landward boundary, and there have been observed declines in extent and/or quality over time that are likely to continue. There are different interpretations of coastal squeeze, but for the purpose of this theme plan, the above definition is used, as it was developed by Natural England and the Environment Agency to describe the issue within the context of reporting on condition of designated sites. Because of the critical point about the presence of a fixed sea defence, the term 'coastal squeeze' would not apply to a cliff situation where recession as a result of land-sliding or erosion was occurring. It would not apply to a situation where fixed structures were absent and the intertidal area was backed by naturally rising ground: in such cases this would be considered as 'natural change'.

Maintaining or installing structures and/or operations to manage flood and erosion risk may require assessment under the Habitats Regulations where they are in or near Natura 2000 sites particularly if the conservation objectives make reference to the supporting processes on which the qualifying habitats rely. The strategic approach using SMPs has helped to identify these impacts at a high level. Implementing measures to avoid damage has to be part of the longer-term approach. Change at the coast may also happen naturally, and there is a need to understand the natural dynamics in the absence of any human activities.

3. Description of key issues

The Living with the Sea project (Rees and others 2004) highlighted the need to integrate FCERM with management of the Natura 2000 network. This mainly focused on the coastal squeeze issue, but did address some other elements of coastal management.

3.1 Sea walls

Sea walls built to manage saline flooding have led to an unnatural cut off between saline and freshwater systems. Freshwater habitats have different ecological requirements; wetlands such as reedbeds and grazing marshes support important populations of birds, and are often within SPAs. Where these habitats occur on the former coastal flood plain, they depend on the maintenance of artificial coastal defence structures, such as sea walls, or the manipulation of natural features such as a shingle or dune ridge, to limit saline flooding. However, in the face of relative sea level rise and shoreline change, these defences don't allow designated intertidal habitats to adapt to sea level rise. The measures necessary to maintain coastal intertidal features often require the restoration of coastal processes, whereas the protection of the freshwater habitat depends on the maintenance of defence structures in their current location.

3.2 Climate change and sea level rise

In the decade or more since the *Living with the Sea* project presented its conclusions, further work to describe the implications of climate change for the coastal environment have been addressed in a number of recent evidence reviews (Rees and others 2010, Mossman and others 2012, Jones and others 2013, Adaptation sub-committee 2013). The coastal environment also provide a wide range of ecosystem services, including making a significant contribution to flood and erosion risk management.(Jones and others 2011, Moëller and others 2014). It is increasingly evident that the intertidal and other habitats and sediment processes actually form an essential element of flood and erosion risk management. These processes contribute to flood and erosion risk management as a result of the presences of vegetation and sediments physically reducing the levels of wave energy.

Where there are freshwater or other types of Natura 2000 sites behind sea defences, Government policy first established in 1998 was to maintain these *in situ* where it is economically, technically and sustainably possible. There is now more recognition[5] that there needs to be adaptive management of the coast in response to sea level rise and climate change, and that holding the existing line in all locations currently defended will not be technically or economically possible. Maintaining the same level of risk management in future will increase in cost as structures will need to be bigger in the face of rising sea levels. (Adaptation Sub Committee 2013[6]). In essence, coastal risk management will need to adapt for a range of reasons. If the Natura 2000 habitats and species are to be sustained, we need better predictions of where, and at what rate, change will occur, and develop strategies that aim to sustain the wildlife interest, but perhaps in different places. Analysis of change at individual locations clearly indicates measurable losses to the extent of saltmarsh in the last 30 to 40 years (Baily and Pearson 2007, Burd 1991, Cooper and others 2001). Changes will happen at different rates and be influenced by a number of factors; therefore it is difficult to extrapolate measured losses to give predictions for the future. Studies attempting this have signalled the limitations (Royal Haskoning 2006), however it will be necessary to rely to some extent on predictions to ensure habitat creation measures are initiated before losses occur. If this doesn't happen we will fail to meet obligations for the Natura 2000 series. One approach could be to use information about coastal and estuary morphology and sediment processes to help identify where most effective targeting of habitat creation should take place that

[5] See National fcrm strategy at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228898/9780108510366.pdf and National Adaptation programme: https://www.gov.uk/government/publications/adapting-to-climate-change-national-adaptation-programme

[6] http://www.theccc.org.uk/wp-content/uploads/2013/07/ASC-2013-Book-singles_2.pdf

maintains a sustainable, but dynamic, coastal or estuary form and helps ensure that habitat created can be effectively maintained in the longer term[7].

Experience of habitat creation and adaptation is increasing from schemes implemented to address inappropriate coastal management and to compensate for coastal squeeze. These are demonstrating the benefits of developing an adaptive approach (i.e. where there is a change in SMP policy which is implemented within a clear timescale). Managed change to enable adaptation to sea level rise is considered more desirable than withdrawal of maintenance, as it is a planned process rather than allowing defences to fail over time. However, there is still the need to reduce public and political resistance to such changes, especially where the longer term costs are beneficial. Adaptive coastal management can often result in long-term savings, but may have a high cost initially. The implications to the landowner and land prices also need to be identified. Natural England has developed the National Biodiversity Climate Change Vulnerability Assessment Tool (NBCCV Assessment Tool) that allows us to undertake analysis of current datasets to provide an assessment of the relative vulnerability of priority habitats to climate change. This will help to assess vulnerability and target action to increase biodiversity resilience, and could be used to indicate areas within Local Plans where coastal adaptation is needed the most, and linked to SMP policies.

4.Case studies

Two good examples of changes to coastal management relevant to Natura 2000 site complexes are the Cley-Salthouse scheme and the Medmerry managed realignment. Both of these addressed ongoing issues of inappropriate coastal management at a site level and demonstrate a more sustainable approach to flood risk management. Both are examples of where adaptation has helped to meet conservation objectives for the features, and are linked into site-level and strategic planning to manage flood risk more sustainably. Both examples demonstrate the need for co-operation, communication, good evidence as well as being innovative and working with natural processes.

4.1 Case study A: Cley-Salthouse, Norfolk

This location (approx. grid ref TG062448)has a number of national and international designations for habitats and species: SAC, SPA, Ramsar, SSSI (for biological and geomorphological features), and NNR. It is a very popular area and managed by the Norfolk Wildlife Trust and National Trust. This location is fronted by a shingle beach ridge that extends into the Blakeney Point shingle spit. The shingle beach, derived from natural deposits of sediment from longshore drift, forms the primary flood defence for grazing marsh, reedbed and saline lagoons and a number of properties in coastal villages. The ridge used to be bulldozed each year to raise the crest height. The annual cost of this was £90,000. This had been carried out for at least 40 years, but decreases in sediment volume and a series of storm events led to a review of the approach after 1998 as the standard of defence was declining. Information in the Futurecoast[8] study warned that without a change the profiling would lead to '*eventual catastrophic failure of an artificially over-steepened shingle bank during storm events'*. Reprofiling was also considered to be inappropriate to the shingle conservation interest. The operation was stopped in 2007 and a change in approach to flood risk management was introduced.

The FCERM solution was developed by Environment Agency in partnership with local and national organisations, with advice from Natural England. The Wildlife Trust, National Trust and local authorities facilitated community engagement and agreement and was linked to improvements in visitor facilities and interpretation. Works included:

- Drainage improvements to enable outflow of water after overtopping of the shingle ridge.

[7] See the Healthy Estuaries report at http://publications.naturalengland.org.uk/publication/4734703644966912?category=6337991412809728

[8] http://www.coastalwiki.org/wiki/FUTURECOAST_project,_UK or the Defra/EA research summary: http://www.estuary-guide.net/pdfs/FD2002_499_FRP.pdf

- Excavation of a new river channel to allow migration of the shingle ridge across the route of the old channel.
- Construction of a sluice linking the new river channel and the drainage improvements.
- Cessation of shingle reprofiling by bulldozers to allow a natural ridge form to be restored and evolve through natural processes.
- Creation of new reedbed offsite to compensate for anticipated longer -term losses to bittern habitat.

4.2 Case study B: Medmerry managed realignment scheme

This scheme was developed on an existing SSSI to provide 183 ha of intertidal and other habitats as compensation for losses of intertidal habitat in The Solent SAC, as identified in the SMP and its supporting studies. On that Natura 2000 site, sea defences had to be maintained to manage flood risk to developed areas and there were limited realignment opportunities to create new habitat directly adjacent to the site. The location of the realignment scheme (Grid ref SZ 828947) was a nationally designated site that was being affected by inappropriate coastal management of the shingle ridge, and had similar issues to the Cley case study site. The project was developed by Environment Agency in partnership with other national and local bodies, with full and positive engagement from the local community and private interests needing flood defences. The site is now managed as an RSPB reserve. The award-winning project included the following works:

- Construction of new set back line of defence;
- Construction of rock groynes;
- Breach of shingle ridge;
- Creation of topographic variation; and
- Planning for visitor access and interpretation.

The realignment project provided effective compensation for coastal squeeze, addressed an existing problem of coastal management impacting on nationally designated features and also provided a more sustainable approach to flood risk management.

5. Scale of the issue

The process to develop Site Improvement Plans (SIPs) during 2013-2015, for the IPENS programme has identified the sites listed in Annex 4 as being affected by these issues. In March 2015, according to the SIP data, 58 SACs and SPAs are either affected by or at risk from coastal squeeze, while 34 SACs and SPAs are affected by or at risk from inappropriate coastal management. However it is worth noting that some issues listed as coastal squeeze in the SIPs may be incorrectly listed (i.e. they may actually be inappropriate coastal management issues) and that as stated in Annex 4, the SIPs are dynamic documents which can be updated in the future. This theme plan provides definitions of both inappropriate coastal management and coastal squeeze which will aide SIP authors in the future to correctly identify what category of issue is occurring on different sites.

The features that could be affected were identified at the August 2013 workshop and are listed in Annex 1. In general, the main (but not exclusive) geographic areas affected by coastal squeeze are in the south and east of England and the Severn Estuary, key sites for the conservation of intertidal Annex I habitats and SPA bird species. For inappropriate coastal management, there are a number of sites with specific issues. These are either where there is a legacy of past intervention to reduce flood or erosion risk that still causes problems for coastal processes, or where there is an identified risk to people and properties from flooding or erosion requiring works in future. The overall area of direct impacts on site condition for SSSIs is smaller than for coastal squeeze (c.515ha from SSSI view), but indirect impacts on coastal processes can affect a wider area.

The development of SMPs and associated regional habitat creation programmes has progressed in the last few years, with the key principles now embedded in government policy. Due to the long-term nature of SMPs, with 3 ‘epochs’: up to 2025, 2026 to 2055, and 2056 to 2105, implementation of policy changes can be delayed for a

variety of reasons. The Habitats Regulations Assessments (HRA) of SMPs largely concluded that in order to be compliant with the Habitats Directive, these plans must include plans to develop compensatory habitat. This pro-active habitat replacement in advance of losses, which should also cover past losses (something not set out in previous SMPs), and as part of strategic plans, was supported by the European Commission in response to the HRA of the plans in 2011. These approaches will need to be readily auditable and transparent so that the statutory drivers and outcomes are clear. This will be necessary to allow Government to inform the European Commission of any compensatory measures adopted. The habitat creation plans typically form part of the SMP, an example for the SMP7 Lowestoft to Felixstowe is at:

http://www.suffolksmp2.org.uk/policy/index.php

Should habitat creation be required, there are a range of other issues that need to be addressed. Securing funding is essential, along with long-term security of the land, ideally with a relevant partner organisation such as the RSPB or other NGO. Habitat creation will require adequate monitoring, formal designation of new sites, changes to designated site boundaries and review of conservation objectives. This will require longer-term input led by Natural England, and including wider consultation.

While planning for managed change is a key element of coastal management, the issue of extreme events that result in rapid change of the coast also needs to be considered. This was illustrated in the 2013/14 winter storms and the response to it. Around the country, many designated sites were affected. However any response must take account of the recovery of habitats following the storm, and whether breaches in sea walls should be repaired or adapted to continue saline inundation. Such events can bring anticipated changes forward, and affect the ability to provide replacement habitat in advance of these changes. Understanding the condition of assets will help to identify risk areas, which should also make use of risk mapping tools developed from the EA.

6. Available mechanisms

6.1 Strategic coastal planning

For designated coastal sites, strategic coastal planning through SMPs and coastal strategies provides the main mechanism to address coastal squeeze, with site-specific remedies provided for inappropriate coastal management. The Environment Agency has the coastal overview, but will work with other public bodies in relation to SMP policies specific to flood and coastal erosion risk management. These are non-statutory plans which help inform decisions made under the planning system (for example see figure 1 of the National Flood and Erosion Risk Strategy at https://www.gov.uk/government/publications/national-flood-and-coastal-erosion-risk-management-strategy-for-england). There is a process in place, which has been agreed with the Environment Agency and coastal authorities to ensure these follow the necessary procedures where Natura 2000 sites are concerned, including the need for Habitats Regulation Assessment where Natura 2000 sites are affected.

While most flood defence structures are maintained by the EA, the issue of how to integrate management of private defences within a wider strategy also need to be addressed.

6.2 Compensatory habitat creation

Identifying suitable areas in advance for creating compensatory habitat (that would be outside the designated site affected) is an issue. Availability, local acceptance and cost are factors, as well as the need for a range of consents including planning permission.

Development and design of compensatory habitat and methods used need to be factored in with issues of local flood risk management and the ability of the creation scheme to help manage flood risk. In some cases the requirement for compensation under the Habitats Directive has released additional funding that would not otherwise be available for ‘conventional’ flood risk management.

6.3 Water Framework Directive (WFD)

The WFD is a key driver for coastal work that will affect Natura 2000 sites at the coast. River Basin Management Plans (RBMPs) are required under Water Framework Directive (WFD) which establishes an 'umbrella' framework for the protection of rivers and lakes, wetlands, groundwaters, estuaries and coasts (to 1 mile). The plans are led by the Environment Agency but Natural England has a keen interest and significant involvement in their development and delivery.

The consultation on updated River Basin Plans, (RBMPs) launched in October 2014, will help decide what measures are included in plans, to improve the freshwater and coastal environment, for the next 6 years and beyond. RBMP's are the strategic document along with Flood Risk Management Plans (FRMPs) to capture measures needed to address coastal squeeze. The detailed work needed will be held in individual coastal strategies/schemes and referenced in the FRMPs.

The new FRMPs – which will include measures drawn from Catchment Flood Management Plans (CFMP)s and SMPs plus new schemes – will be key strategic planning mechanisms. The FCRM investment programme, running in parallel to the FRMPs, influences how funding is allocated so also a key vehicle for taking forward schemes once they've been developed.

Under the WFD there is a suite of monitoring work underway to enable reporting on progress towards good ecological status. This includes evaluation of the extent and quality of saltmarshes in surveillance water bodies and in heavily modified water bodies.

7. Addressing outstanding issues

7.1 Issues and potential solutions identified at the 2013 IPENS coastal workshop

Addressing the issue of inappropriate coastal management or coastal squeeze can require the creation of new intertidal or other habitat. Habitat creation schemes to provide compensatory habitat can take several years to develop and implement. At the 2013 IPENS workshop a number of blockages and potential solutions around habitat creation were identified by the delegates, and these are discussed below in sections 7.1 to 7.7 below. These sections contain the views and ideas of the delegates and are not necessarily reflective of Natural England's view.

7.1.1 Evidence issues

It was felt that in some cases a limited evidence base has or will be used as a reason for not taking action on inappropriate coastal management. The solution suggested was to have clarity over a range of evidence concerning habitat changes, and to make better use of applied academic studies. Action could be taken then on a precautionary basis, including other important factors such as benefits for people and flood risk management.

The understanding of freshwater systems (saltmarsh vs grazing marsh) by both Natural England and other organisations, was questioned at the workshop and it was felt that there is a need for more effective research on the ecological requirements of interest features.

7.1.2 Organisational issues

Integration between organisations (particularly between Natural England and the Environment Agency over FCERM & data) would be improved by using agreed methods and aligning priorities.

A lack of clarity in roles (the Internal Drainage Board was used as an example), can be a problem. Better use of these types of organisation and proper investment in the them, would allow better partnership working.

7.1.3 Timescale issues

One major timescale issue with habitat creation is that the run-in time for managed realignments is at least 5 years. Strategic local plans, future planning, and better funding would potentially facilitate a shorter run-in time. Additionally, funding further in advance, for example ongoing funding using HLS (Note: HLS was the agri-environment scheme in place at the time of the workshop, however it is now Countryside Stewardship) taking away the uncertainty for future management), would allow a reduction in run-in times.

7.1.4 Funding issues

There is a need to create more flexibility in funding, with multiple benefits to be recognised in bids, as well as transferral of funds from one body to another to be made easier. The cost of managed realignment schemes in particular are very large, and a recent ABPmer report covers the costs in detail[9].

7.1.5 Communication issues

A concern was raised around coastal access and rights of way, where access routes exist on sea walls that may be breached. Adequate alternative routes must be found, and early advance engagement and communication with access organisations needs to take place.

Inadequate communication between organisations around coastal management could be improved by provision of appropriate guidance and ample feedback opportunities. Also better use of existing communication routes, would help this issue, and good use of coastal partnerships and forums.

7.1.6 Prioritisation issues

There was a feeling that organisations are not always recognising (and therefore not prioritising contribution to) these sites – (i.e. habitat creation as compensation for coastal squeeze) and that the value of these sites can be hard to see. Some attendees felt that Natural England and the Environment Agency do not promote the value of these sites enough. The solution that was suggested is that Natural England and the Environment Agency need to embed the value into strategic plans and policy, including sites for managed realignment, to tie in with Coastal Change Management Areas (CCMA) and benefits to local communities. Also, ensuring that funding for habitat creation is clear, would help local contributions to be given where needed.

7.1.7 Strategic issues

A risk averse and over-precautionary approach to change can hinder appropriate coastal management, and the solution suggested was to go beyond the minimum and be more visionary on National Nature Reserves (NNRs), and to find an appropriate balance between different competing habitat types.

There is great political sensitivity around habitat creation and provision of briefings and the delivery of information 'up front' would help to deal pre-emptively with political will issues.

Having a strategic overview of related issues is vital, and should not be moved away from – Natural England and the Environment Agency could agree an actions overview with a more supportive approach from Defra.

7.2 Issues identified during the writing of this plan

Other critical factors that were identified during the development of this plan included:

- Funding of works to deliver compensatory habitat and multiple objectives: determining sources and alternatives where public resources are limited and clarity over how resources are allocated between flood risk management delivery and habitat compensation

[9] ABPmer report on the costs of managed realignment schemes
http://www.abpmer.co.uk/Buzz/The_Cost_of_Managed_Realignment/

- Communication and engagement and the role of local partnerships to promote benefits of habitat creation, making sure there is adequate capacity to front-load engagement.

8. Achieving better outcomes

It is broadly accepted that the management of protected sites must be integrated with flood and coastal erosion risk management due to legal and policy obligations. There are also clear examples of where managed realignment or schemes to address inappropriate coastal management have helped to reduce flood risk, for example at Medmerry. There is good evidence of the value of saltmarsh vegetation to flood risk management, and it has been clearly demonstrated that it reduces wave energy (Möller and others 2014). Work is underway on projects linked to the management of Natura 2000 sites, to try and identify the most optimal locations for managed realignment or other measures that promote healthy estuary function, and also to improve understanding of how habitat creation sites develop[10].

Climate change adaptation is increasingly focused on adaptive management and indications are that by not taking this approach, the public purse will not be able to cover the increasing costs of maintaining all existing defences (ASC report –key messages http://www.theccc.org.uk/wp-content/uploads/2013/07/ASC-2013-Chap5_singles_2.pdf). Changes to the status quo will be difficult, against an expectation that public funding for structures and operations will be available. The SMP policies do indicate that changes will be needed, not just for environmental objectives but to improve sustainability of coastal management. Other policy areas including land use planning also indicate the need for adaptation as part of sustainable development.

At the IPENS 2013 workshop, a list of ambitions for tackling inappropriate coastal management was produced and this can be seen in Annex 5.

9. Implementation and priority actions

There needs to be co-ordinated action and wider dialogue to address the blockages identified, and to ensure that additional ones are also highlighted. As nearly a third of the internationally designated sites in England are at the coast, actions that lead to more sustainable risk management that works better with natural processes will benefit the Natura 2000 network.

The table below outlines the recommended actions for implementing this theme plan. It indicates the next steps required to progress the approach outlined. The actions table should not be seen as a fully funded, committed-to implementation plan. It is aimed at informing future resource decisions of the delivery bodies involved. Implementation of the theme plans will be coordinated through the IPENS After-Life programme and its steering group.

It summarises those actions identified in earlier sections of this document, which are recommended to address outstanding issues for inappropriate coastal management. Actions are mainly strategic rather than site specific and are subdivided into themes as follows:

- high level strategic recommendations;
- policy recommendations; and
- site level implementation.

[10] See the Healthy Estuaries report at http://publications.naturalengland.org.uk/publication/4734703644966912?category=6337991412809728

Priority Actions Table

Action no.	Action description	Timescale	Delivery bodies / partnership
HIGH LEVEL STRATEGIC RECOMMENDATIONS			
1	NE and EA to work with local authorities/stakeholders in identification of potential locations for habitat creation; promote the links with delivery of flood risk management and Coastal Change Management Areas (CCMA). Create case studies using local groups.	From 2015	NE & EA in partnership with LAs and stakeholders (through coastal partnerships).
2	Ensure it is clear how coastal processes and habitats play a key part in reducing risks, make use of information in the 2013 Adaptation Sub-Committee report.	From 2015	NE with other partners as appropriate
3	Land prices to have realistic valuations when projects are taken forward.	To link to implementation of strategies	
4	Evaluate the ecosystem services benefits arising from coastal evolution, which should include how these can be valued as part of cost benefit analyses.	To link to implementation of strategies	
5	Integrate managed realignment work into collective innovative projects such as beneficial use of dredged material to build up levels of intertidal sediment, recognising this may be a short-term measure.	From 2015	EA and other local initiatives
6	All stakeholders (e.g. Local Authorities, NGOs, IDBs, and the public) should be part of the dialogue around inappropriate coastal management issues, recognising that the EA plays the key role in planning and delivery.	From 2015	EA / NE and other partners as appropriate
7	Ensure that habitat creation is factored into the RBMPs and delivered within the timetable set out in those.	From 2015	EA
POLICY RECOMMENDATIONS			
8	Restoration of coastal processes and habitats should be fully recognised as part of the delivery of flood and erosion risk policies.	From 2015	NE, EA & DEFRA
SITE LEVEL *and other implementation e.g. large-scale (actions concerned with delivery at the site or wider landscape level)*			
9	More effective use of the 'no active intervention' policies in specific locations to demonstrate effects of storm events and coastal response and how these relate to delivery of conservation objectives.	No specific date. Site by site timetable needs to be set out	EA & NE with other partners as appropriate

10	Development of reliable, trusted and repeatable evidence is needed to demonstrate changes to intertidal habitat linked to presence of coastal management, how this takes account of the Natura 2000 network, and the need for creation of new habitat, and also to demonstrate the suitability of available techniques and management needs to deliver specific objectives	From 2015-2020	NE and EA
11	Better partnership between public and private organisations through existing or new partnerships. Use good contacts already established and engage at all levels to avoid 'top-down' direction. Policy should help people understand why some actions are needed.	From 2015	NE / EA / LA in partnership with private organisations and stakeholders.
12	Greater emphasis on freshwater habitat creation away from saline flood risk and plan ahead as creation of replacement habitat takes time, so develop timetables for action and responsibilities. Develop mechanisms to invite participation.	From 2015, linked to Regional Habitat Creation Plans	EA and NE
13	Showcase well-designed flood and erosion risk management that works with coastal processes, to build a better appreciation of the need for adaptation and flood resilience.	From 2015 (example Medmerry)	EA

Annex 1. Features identified as 'at risk'

Features identified in the workshop that are likely to be affected in some way if no action is taken. (primarily coastal squeeze: ICM indicates Inappropriate coastal management).

Habitats:

- Eelgrass
- High level saltmarsh
- Upper and mid-saltmarsh
- Mediterranean and thermo-Atlantic saltmarsh scrub (*Suaeda vera*)
- Freshwater marshes
- Saltmarshes
- *Spartina maritima* swards
- Atlantic saltmeadow
- Mudflat
- Saline lagoons
- Tidal / saline lagoons / brackish habitats in general
- Freshwater habitats behind coastal defences
- Yellow dunes
- Shingle habitats (perennial and annual)
- Sandy beaches
- Cliff & clifftop habitats
- Heathland

Birds

- Shingle nesting birds due to flooding
- Little & sandwich terns & ringed plover
- Saltmarsh roosting / breeding birds (e.g. grey plover & dunlin)
- Overwintering waders (especially species not using adjacent freshwater / agricultural habitats)
- Breeding Annex 1 birds (e.g. terns, avocets etc)
- Overwintering wildfowl
- Waders, gulls & terns

Other species

- Upper saltmarsh species
- Starlet sea anemone
- Fishers estuarine moth
- *Vertigo angustior*
- Petalwort on dune slacks (ICM)
- Shore dock in dunes and on cliffs (ICM)
- *Spartina maritima*
- Specialist invertebrates (saline & brackish)
- Saltmarsh flora

- All species in habitats currently protected by coastal defences (e.g. coastal freshwater, heathland etc) for which adaptation will be needed, or accept a degree of change

Annex 2. Example types of inappropriate coastal management

- Presence of defence structures or engineering works that modify coastal processes, such as cliff stabilisation by hard engineering
- Structures or operations to reduce flood risk to ports, marinas etc.
- Dredging for navigation or other purposes
- Training walls, groynes, rock armour, offshore reefs or other structures to influence sediment and water movement
- Extraction or addition of sediment (beach feeding) and mechanical shingle profiling or recycling
- Mechanical beach/strandline clearing and removal of material
- Drainage or other alteration of hydrological processes e.g. on cliff slopes or to dune hydrology
- Any other form of stabilisation or drainage of cliff systems or other coastal habitat

Annex 3. List of IPENS theme plans

IPENS has produced several thematic action plans or 'Theme Plans', some of which relate to issues discussed in this theme plan. The full list of theme plans can be found below:

Theme plan	Weblink
Atmospheric nitrogen	http://publications.naturalengland.org.uk/publication/6140185886588928?category=5605910663659520
Climate change	http://publications.naturalengland.org.uk/publication/4954594591375360?category=5605910663659520
Diffuse water pollution	http://publications.naturalengland.org.uk/publication/5848526737113088?category=5605910663659520
Grazing	http://publications.naturalengland.org.uk/publication/4839898496368640?category=5605910663659520
Habitat Fragmentation	http://publications.naturalengland.org.uk/publication/5004101806981120?category=5605910663659520
Hydrological functioning	http://publications.naturalengland.org.uk/publication/6400975361277952?category=5605910663659520
Coastal management	http://publications.naturalengland.org.uk/publication/6371629661683712?category=5605910663659520
Invasive species	http://publications.naturalengland.org.uk/publication/6130001713823744?category=5605910663659520
Lake restoration	http://publications.naturalengland.org.uk/publication/5583022327857152?category=5605910663659520
Public access and disturbance	http://publications.naturalengland.org.uk/publication/6621454219083776?category=5605910663659520
River Restoration	http://publications.naturalengland.org.uk/publication/5478339747774464?category=5605910663659520

Annex 4. SIPs listing Coastal Squeeze or Inappropriate Coastal Management as an issue

This data was extracted from the SIP database in March 2015 – it should be noted that this was prior to the publication of this theme plan which contains clear definitions of both inappropriate coastal management and coastal squeeze. These definitions can be used by SIP authors in the future to update the issue categories where the issue may have been incorrectly listed as coastal squeeze, when it would be more accurate to list as inappropriate coastal management.

SIP NAME	SAC / SPA NAME	ISSUE NAME
Alde-Ore Estuaries	Alde-Ore & Butley Estuaries SAC	Coastal squeeze
Alde-Ore Estuaries	Alde-Ore & Butley Estuaries SAC	Inappropriate coastal management
Alde-Ore Estuaries	Alde-Ore Estuary SPA	Coastal squeeze
Alde-Ore Estuaries	Alde-Ore Estuary SPA	Inappropriate coastal management
Alde-Ore Estuaries	Orfordness-Shingle Street SAC	Coastal squeeze
Alde-Ore Estuaries	Orfordness-Shingle Street SAC	Inappropriate coastal management
Beast Cliff-Whitby (Robin Hood's Bay)	Beast Cliff-Whitby (Robin Hood's Bay) SAC	Inappropriate coastal management
Braunton Burrows	Braunton Burrows SAC	Inappropriate coastal management
Broadland	Broadland SPA	Inappropriate coastal management
Broadland	The Broads SAC	Inappropriate coastal management
Chesil Beach & The Fleet	Chesil & The Fleet SAC	Inappropriate coastal management
Chesil Beach & The Fleet	Chesil Beach & the Fleet SPA	Inappropriate coastal management
Deben Estuary	Deben Estuary SPA	Coastal squeeze
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	Dee Estuary SAC	Coastal squeeze
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	Dee Estuary SAC	Inappropriate coastal management
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	Mersey Narrows and North Wirral Foreshore SPA	Coastal squeeze
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	Mersey Narrows and North Wirral Foreshore SPA	Inappropriate coastal management
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	The Dee Estuary SPA	Coastal squeeze
Dee Estuary/Aber Dyfrdwy & Mersey Narrows	The Dee Estuary SPA	Inappropriate coastal management
Dungeness	Dungeness SAC	Coastal squeeze
Dungeness	Dungeness to Pett Level SPA	Coastal squeeze
Dungeness	Dungeness, Romney Marsh and Rye Bay pSPA	Coastal squeeze

Durham Coast	Durham Coast SAC	Inappropriate coastal management
Essex Estuaries	Blackwater Estuary (Mid-Essex Coast Phase 4) SPA	Coastal squeeze
Essex Estuaries	Colne Estuary (Mid-Essex Coast Phase 2) SPA	Coastal squeeze
Essex Estuaries	Crouch & Roach Estuaries (Mid-Essex Coast Phase 3) SPA	Coastal squeeze
Essex Estuaries	Dengie (Mid-Essex Coast Phase 1) SPA	Coastal squeeze
Essex Estuaries	Essex Estuaries SAC	Coastal squeeze
Essex Estuaries	Foulness (Mid-Essex Coast Phase 5) SPA	Coastal squeeze
Exe Dawlish	Dawlish Warren SAC	Coastal squeeze
Exe Dawlish	Exe Estuary SPA	Coastal squeeze
Great Yarmouth Winterton Horsey	Great Yarmouth North Denes SPA	Coastal squeeze
Great Yarmouth Winterton Horsey	Great Yarmouth North Denes SPA	Inappropriate coastal management
Great Yarmouth Winterton Horsey	Winterton-Horsey Dunes SAC	Coastal squeeze
Great Yarmouth Winterton Horsey	Winterton-Horsey Dunes SAC	Inappropriate coastal management
Greater Thames Complex	Benfleet and Southend Marshes SPA	Coastal squeeze
Greater Thames Complex	Medway Estuary & Marshes SPA	Coastal squeeze
Greater Thames Complex	Thames Estuary & Marshes SPA	Coastal squeeze
Greater Thames Complex	The Swale SPA	Coastal squeeze
Hamford Water	Hamford Water cSAC	Coastal squeeze
Hamford Water	Hamford Water SPA	Coastal squeeze
Hastings Cliffs	Hastings Cliffs SAC	Inappropriate coastal management
Humber Estuary	Humber Estuary SAC	Coastal squeeze
Humber Estuary	Humber Estuary SPA	Coastal squeeze
Isle of Wight Downs	Isle of Wight Downs SAC	Inappropriate coastal management
Leighton Moss	Leighton Moss SPA	Coastal squeeze
Minsmere to Walberswick Heaths and Marshes	Minsmere to Walberswick Heaths & Marshes SAC	Coastal squeeze
Minsmere to Walberswick Heaths and Marshes	Minsmere-Walberswick SPA	Coastal squeeze
Northumberland Coastal	Berwickshire & North Northumberland Coast SAC	Coastal squeeze
Northumberland Coastal	Coquet Island SPA	Coastal squeeze
Northumberland Coastal	Farne Islands SPA	Coastal squeeze
Northumberland Coastal	Lindisfarne SPA	Coastal squeeze
Northumberland Coastal	North Northumberland Dunes SAC	Coastal squeeze
Northumberland Coastal	Northumbria Coast SPA	Coastal squeeze
Northumberland Coastal	Tweed Estuary SAC	Coastal squeeze
Overstrand Cliffs	Overstrand Cliffs SAC	Inappropriate coastal management
Penhale Dunes	Penhale Dunes SAC	Inappropriate coastal management
Plymouth Sound and Tamar Estuary	Plymouth Sound & Estuaries SAC	Coastal squeeze

Plymouth Sound and Tamar Estuary	Tamar Estuaries Complex SPA	Coastal squeeze
Poole Harbour	Poole Harbour SPA	Coastal squeeze
Portland-Studland & St Albans-Durlston	Isle of Portland to Studland Cliffs SAC	Inappropriate coastal management
Portland-Studland & St Albans-Durlston	St Albans Head to Durlston Head SAC	Inappropriate coastal management
Saltfleetby-Theddlethorpe Dunes & Gibraltar Point	Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC	Inappropriate coastal management
Sefton Ribble	Ribble & Alt Estuaries SPA	Coastal squeeze
Sefton Ribble	Ribble & Alt Estuaries SPA	Inappropriate coastal management
Sefton Ribble	Sefton Coast SAC	Coastal squeeze
Sefton Ribble	Sefton Coast SAC	Inappropriate coastal management
Severn Estuary Mor Hafren	Severn Estuary SAC	Coastal squeeze
Severn Estuary Mor Hafren	Severn Estuary SPA	Coastal squeeze
Sidmouth to West Bay	Sidmouth to West Bay SAC	Inappropriate coastal management
Solent	Chichester and Langstone Harbours SPA	Coastal squeeze
Solent	Portsmouth Harbour SPA	Coastal squeeze
Solent	Solent & Southampton Water SPA	Coastal squeeze
Solent	Solent Maritime SAC	Coastal squeeze
Solent and Isle of Wight Lagoons	Solent & Isle of Wight Lagoons SAC	Coastal squeeze
Solway Firth	Solway Firth SAC	Coastal squeeze
Solway Firth	Upper Solway Flats & Marshes SPA	Coastal squeeze
South Wight Maritime	South Wight Maritime SAC	Inappropriate coastal management
Teesmouth & Cleveland Coast	Teesmouth & Cleveland Coast SPA	Coastal squeeze
The Lizard	The Lizard SAC	Inappropriate coastal management
The Wash and North Norfolk Coast	Gibraltar Point SPA	Coastal squeeze
The Wash and North Norfolk Coast	Gibraltar Point SPA	Inappropriate coastal management
The Wash and North Norfolk Coast	N Norfolk Coast SPA	Coastal squeeze
The Wash and North Norfolk Coast	N Norfolk Coast SPA	Inappropriate coastal management
The Wash and North Norfolk Coast	North Norfolk Coast SAC	Coastal squeeze
The Wash and North Norfolk Coast	North Norfolk Coast SAC	Inappropriate coastal management
The Wash and North Norfolk Coast	The Wash & North Norfolk Coast SAC	Coastal squeeze
The Wash and North Norfolk Coast	The Wash & North Norfolk Coast SAC	Inappropriate coastal management
The Wash and North Norfolk Coast	The Wash SPA	Coastal squeeze
The Wash and North Norfolk Coast	The Wash SPA	Inappropriate coastal management

Annex 5. Ambitions from 2013 Coastal Workshop

A list of ambitions of 'where we would like to be' by 2020, was compiled at the IPENS 2013 Coastal Workshop:

1	Not just change on the ground, but hearts / minds & recognition of the benefits.
2	Better appreciation of Flood Risk Management (FRM) & the natural environment.
3	Alignment of priorities – delivery of natural environment priorities and FRM (added value).
4	Adaptive management (changing working practices to deliver what is needed in another way).
5	Clarity of who is responsible for what & associated plans, both those funded by FRM & those done in other ways.
6	Delivery on the ground is clearly helped by these plans – working with community & actual delivery being achieved.
7	Regional Habitat Creation Plans continuing to deliver new habitat.
8	EA seeing & using RHCPs as part of the delivery of IPENS – to help join up / transparency in delivery.
9	Understanding & keeping track of what is needed & provided, and this should be taken forward strategically.
10	Theme Plan embedded in RBMP & meeting objectives by 2015.
11	Strategic monitoring programme in place.
12	Clear about what we need to do to manage existing sites as an interim door-stop solution prior to managed realignment. Part of an agreed pathway.
13	Need a mechanism to fund interim measures as part of a suite of options to manage sites (e.g. recharge).
14	Case-book of lessons learnt from these sorts of management as well as managed realignment – what has worked & not worked.
15	Saltmarshes, dunes and shingle systems recognised as part of natural flood defences without need for intervention.
16	Actively contributing to SSSI targets & biodiversity 2020.
17	The IPENS theme & site plans should be being implemented.
18	Maintenance of sites meeting WFD priorities.
19	Compensation sites being designated / in a programme of designation.
20	Realignment of priorities to deliver quality sites which are fit for legal designation and supported by monitoring.
21	Supported by fast-tracking of designation (pre-emptive).
22	Clear monitoring of sites to ensure we stay ahead of further losses as Climate Change happens.
23	Illustration of full benefits of realignments, maintenance, management of coastal habitats (help to win hearts / minds).

Annex 6. References

Adaptation Sub Committee 2013. Managing the land in a changing climate- Adaptation Sub-Committee progress report 2013. Chapter 5 Regulating services Coastal Habitats. ASC http://www.theccc.org.uk/wp-content/uploads/2013/07/ASC-2013-Book-singles_2.pdf

Baily, B. & Pearson, A. (2007). Change detection mapping of saltmarsh areas of south England from Hurst Castle to Pagham Harbour.. Journal of Coastal Research: Volume 23, Issue 6: 1549-1564.

Burd, F. (1991). Erosion and vegetation change on the saltmarshes of Essex and north Kent between 1973 and 1989. Research & Survey in Nature Conservation 42. Nature Conservancy Council, Peterborough.

Cooper, N.J., Cooper, T & Burd, F. (2001). 25 years of salt marsh erosion in Essex: implications for coastal defence and nature conservation. Journal of Coastal Conservation 7: 31-40.

Defra (2008) A strategy for promoting an integrated approach to the management of coastal areas in England http://www.southerncoastalgroup.org.uk/pdfs/DEFRA%20ICZM%20Strategy.pdf

European Commission. (2002) Recommendation of The European Parliament & of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002H0413&from=EN

European Commission (2004). Living with Coastal Erosion in Europe – Sediment and Space for Sustainability Luxembourg: Office for Official Publications of the European Communities http://ec.europa.eu/environment/iczm/pdf/brochure_en.pdf

JNCC (2013a) http://jncc.defra.gov.uk/page-6387

Joint Nature Conservation Committee (2013b). 10th Report by the United Kingdom under Article 12 on the implementation of the Directive on the conservation of wild birds (2009/147/EC) from January 2008 to December 2012. JNCC, Peterborough.

JNCC (2013c) The UK Approach to Assessing Conservation Status for the 2013 EU Habitats Directive Article 17 Reporting. JNCC, Peterborough. Available to download from http://jncc.defra.gov.uk/page-6563 or http://jncc.defra.gov.uk/page-6564.

Jones, L., Garbutt, A., Hansom, J. and Angus, S. (2013) Impacts of climate change on coastal habitats, MCCIP Science Review 2013, 167-179, doi:10.14465/2013.arc18.167-179

Jones, L. and others. (2011). Coastal Margins Ch 11 In: The UK National Ecosystem Assessment Technical Report: The UK National Ecosystem Assessment UNE-WCMC, Cambridge. http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx

Möller I, Kudella M, Rupprecht F, Spencer T, Paul M, van Wesenbeeck B, Wolters G, Jensen K, Bouma TJ, Miranda-Lange M, Schimmels S (2014) Wave attenuation over coastal salt marshes under storm surge conditions. *Nature Geoscience*, Vol 7 (Oct 2014). doi:10.1038/NGEO2251

Mossman, H. L., Davy, A. J., Grant, A. (2012), Does managed coastal realignment create saltmarshes with 'equivalent biological characteristics' to natural reference sites? Journal of Applied Ecology, 49: 1446–1456. doi: 10.1111/j.1365-2664.2012.02198.x

Rees, S., Worrall, S. & Suddaby, D. (2004). Dynamic Coasts: the next 50 years. Littoral 2004 7th International Symposium proceedings, Eurocoast/EUCC, Aberdeen.

Rees, S., Angus, S., . Rhind, P. and Doody, J.P. (2010) Coastal Margin Habitats *in* MCCIP Annual Report Card 2010-11, MCCIP Science Review, 21pp. www.mccip.org.uk/arc

Royal Haskoning (2006). Coastal squeeze, saltmarsh loss and Special Protection Areas. English Nature Research Report 710. English Nature, Peterborough. http://publications.naturalengland.org.uk/publication/62014

Taylor, S., Knight, M., & Harfoot, A. (2014) National Biodiversity Climate Change Vulnerability Model (NBCCVM) http://publications.naturalengland.org.uk/publication/5069081749225472?category=10003

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