



Sefton Coast Adaptation Study



October 2010



Prepared by:

Graham Lymbery and Michelle Newton
Sefton Council
Coastal Defence
Ainsdale Discovery Centre
The Promenade
Shore Road
Ainsdale-on-Sea
Southport
PR8 2QB
Tel: +44 (0)151 934 2960
Fax: +44(0)1704 575628
Email: Michelle.newton@technical.sefton.gov.uk

Sefton Council

Environmental protection and
Technical services
Magdalen House
Bootle
L20

Tel: +44 (0)151 934 4238
Fax: +44 (0)151 934 4559
www.sefton.gov.uk

Title	Sefton Coast Adaptation Study.
Creator/Author/ Originator/	Graham Lymbery and Michelle Newton
Publisher	Sefton Council
Date of publication	September 2010
Contact name or title of Location	Coastal Defence, Sefton Council
Subject - Keyword	Adaptation, climate change, coastal change
Keyword – Free text	
Description/Abstract	This adaptation study considers the potential impacts of coastal change on the Sefton Coast to ensure we are in a position to manage changes to our coast in the years ahead. This study will identify risk and opportunities arising from coastal change (including climate change) on a risk based approach to highlight the issues for partners so that they can consider options and how these might be included in their policy documents and management plans.
Identifier	
Coverage - Spatial	Sefton Coast
Coverage - Temporal	2010 -2110
Format/ Presentation type	Document Digital
Type	Report
Subject - Category	Coast
Subject - Project	
Language	English
Rights - Copyright	O/S maps reproduced under licence number 100018192 2010 by Sefton Metropolitan Council from the Ordnance Survey's 1:50,000 map with the permission of the controller of Her Majesty's Stationary Office Crown Copyright reserved
Rights - EIR disclosability indicator	Yes
Rights - EIR exemption	
Rights - FOIA disclosability indicator	Yes
Rights - FOIA exemption	
Postal address of location	Ainsdale Discovery Centre, The Promenade, Shore Road, Ainsdale-on-Sea, Southport
Postcode of location	PR8 2QB
Telephone number of location	+44 (0)151 934 2960
Fax number of location	+44(0)1704 575628
Email address of location	coastaldefence@technical.sefton.gov.uk
Online resource	www.sefton.gov.uk
Date of metadata update	

Sefton Coast Adaptation Study

Purpose of this study

This adaptation study will consider the potential impacts of coastal change including climate change on the Sefton Coast to ensure we are in a position to manage changes to our coast in the years ahead. This study will identify risk and opportunities arising from coastal change (including those driven by climate change) on a risk based approach. This study will help highlight the issue of coastal change for partners so that they can consider options and how these might be included in their policy documents and management plans.

The Sefton Coast

The Sefton coast, which extends over 36 kilometres (22 miles), comprises soft and granular estuary deposits of sand, silt, clay and peat. There are no natural outcrops of rock along the shoreline. Hence, the forces of nature readily mould the shoreline, so it is constantly changing in response to the fluctuating influence of wind and water and as a result of human activity. Its overall shape derives from two major river estuaries, the Mersey and the Ribble. The river Alt and Crossens channel also have important local zones of secondary influence.

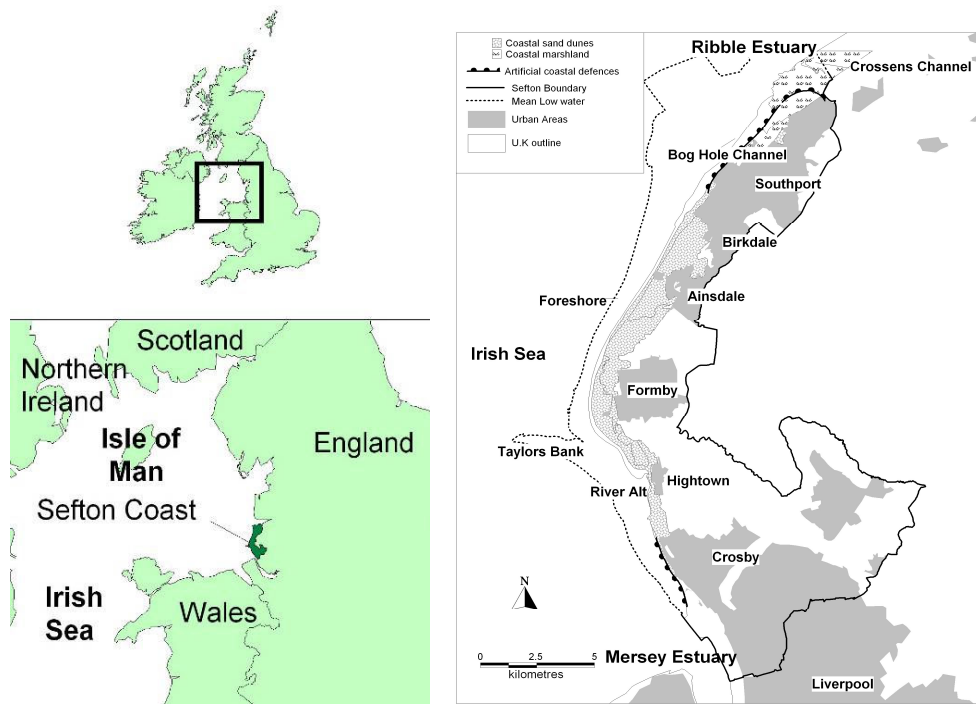


Figure 1: General location plan of the Sefton

The Sefton Coast is nationally and internationally important as it hosts the largest dune system in England, comprising 20% of sand dunes and 40% of dune wetlands which support a significant number of important plant and animal species. These include the Dune Helleborine, Natterjack Toad, Sand Lizard and Red Squirrel. The Sefton Coast is designated as a Special Area of Conservation (SAC) Special Protection Area (SPA), international Ramsar Site and a Site of special Scientific Interest (SSSI) with a number of National and Local Nature Reserves and sites of geological interest.

Why do we need an adaptation study?

The Department for Environment, Food and Rural Affairs (DEFRA) has recently developed a series of performance indicators one of which is related to adaptation to climate change (National Indicator 188) which is designed to:

- Assess risk and opportunities from climate change
- Take action in priority areas to ensure risks and opportunities are continually assessed and monitored

- Develop an adaptation strategy and action plan to reduce risks of climate change
- Implement and monitor actions taken to reduce risk

(DEFRA 2008)

This national indicator to which Sefton has signed up to is designed to ensure local authorities are sufficiently prepared to manage risks to service delivery, the public, local communities, local infrastructure, businesses and the natural environment from a changing climate, and to make the most of new opportunities.

DEFRA are also developing a policy on adaptation to coastal change which was consulted on in June 2009 and as a result of the consultation an £11 million pathfinder programme was set up to enable local authorities to test new approaches to adapting to coastal change. This programme is set to run until spring 2011 which will help inform the development of the coastal change policy through learning from experience of pathfinder authorities. Sefton is one of the Pathfinder authorities, we were successful in applying for funding to work on specific aspects of adaptation relevant to our area but from which we will be able to provide generic lessons for other areas. More information on DEFRA's approach to adaptation to coastal change can be found at <http://www.defra.gov.uk/corporate/consult/coastal-change/consultation-doc.pdf>.

Locally the Sefton Coast experiences significant change and the rate and nature of this change will be influenced by climate change. Initial studies have already identified the potential for significant impacts on a range of habitats into the future based upon current rates of change with the threat of potential sea level (Newton, 2009).

Climate change, adaptation and mitigation

There is mounting evidence that our climate is changing caused by a combination of both natural and human induced factors. However, there is

growing evidence that human activities are a major cause of our changing climate. We are currently locked into a period of change over the next 30-40 years as a result of past emissions of green house gases. These gases remain in our atmosphere for long periods of time and have the ability to influence our climate into the future. Although efforts are being made today to reduce our emissions of such gases we will need to devise adaptation measures to cope with the immediate effects in response to past excessive emissions. This doesn't however mean we should stop reducing our green house gases (**mitigation**); we should make more of an effort to do so through energy reduction for example, whilst also responding to inevitable impacts of climate change (**adaptation**) as ours and future generations quality of life depends on us doing so.

Adaptation – Adaptation is an adjustment in natural or human systems in response to actual or expected coastal change and climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

(adapted from IPCC 2001)

Mitigation – A human intervention to reduce the *sources* or enhance the *sinks* of *greenhouse gases*.

(adapted from IPCC 2001)

Future climate change projections on the Sefton Coast

Globally our climate is changing and we are likely to see and feel the effects of this change through warmer wetter winters, hotter drier summers, increased storminess* and sea level rise. UKCIP09 projections for Sefton indicate we are likely to see over the next 50-100 years:

- A rise in maximum summer temperatures by 2-4 °c
- The warmest day of the year to rise by 4 °c
- Increased occurrence of “mini heat waves”
- Summer rainfall may decrease by on average 11%
- Winter rainfall may increase on average by 20%
- Extreme storms may be more frequent and intense with rainfall events in excess of 150-200mm in one day leading to increased flooding events

- Sea levels may rise by up to 85cm

*storminess is mentioned as a threat but it is not being used in the predictive element of the risk assessment due to uncertainty around the form it may take.

Future impacts of climate change on the Sefton Coast

An assessment of a number of key areas that could be heavily impacted upon by climate change on the Sefton Coast has been undertaken. The key broad areas identified as being at risk are:

- Nature conservation
- Tourism, leisure and recreation
- Agriculture
- Infrastructure and development
- Archaeology
- Industry
- People

Specific features within these broad areas have been looked at in more detail (see appendix) in terms of threats and opportunities arising from coastal change and climate change. The level of detail for each area will vary depending on the knowledge available and who is responsible for that area. As the report is being produced by the Coastal Defence team it will include more detail for this area, for other areas the report seeks to raise awareness with those who have the responsibility and authority to take actions forward.

Nature conservation

The Sefton Coast is of international importance for wintering and passage waterbirds and for its rare dune habitats and species. The extensive foreshore zone along the Sefton Coast is part of the Liverpool Bay complex of coastal and estuarine habitats. The sand dunes of the Sefton Coast form the largest dune system in England. Habitats include embryo dunes, mobile dunes, fixed dunes, dune slacks, dune scrub and dune heath. Rare species include Sand

Lizard, Natterjack Toad, Great-Crested Newt and Petalwort (a bryophyte). The extensive coastal pinewoods support a dense population of the Red Squirrel.

The coast is protected through a series of designations. The intertidal foreshores, salt marsh and grazing marshes form part of the 12,400 hectare Ribble and Alt Estuaries Special Protection Area (EU Birds Directive). This area, along with the wet slack system in the dunes, is also designated as a Ramsar Site (internationally important wetlands). In addition the Sefton Coast Special Area of Conservation (EU Habitats Directive) covers 4,500 hectares of beach and dune habitats. In 2000, a number of sites were amalgamated to form the Sefton Coast Site of Special Scientific Interest (SSSI).

A number of elements have been identified that would benefit from more research to better understand the potential impacts; these are:

- mobile sand dunes where we need a better understanding of how anthropogenic features might interfere with them rolling back
- intertidal areas where we need to continue monitoring in order to confirm whether or not the shore is steepening leading to a reduction in area
- potential habitat development on the accreting sections of the coast.

The following statement was supplied in relation to birds from Steve White (Lancashire Wildlife Trust): “The general predictions in relation to climate change and birds are that we are likely to see continuing and perhaps accelerating changes in species composition and distribution.

With respect to wintering/passage birds it is difficult to foresee any species that are likely to 'replace' the present species in any significant numbers. The main changes here are a movement away from the previously relative warm winters of the British west coast to the British east coast and continental Europe as winters there become milder. Some populations that currently winter in southern Europe and North & West Africa may stay further north in increasing numbers but this is, I suspect, more likely to 'benefit' the east coast.

Over the next 20-50 years if summers continue to warm up then we can probably expect a handful of new breeding species - Avocets at Marshside being the most recent example. Dartford Warbler and Woodlark (probably both on the dune heaths or any clear fell areas) are good candidates.

But for the UK as a whole the outlook is on balance negative for breeding birds, both in terms of population sizes and to a lesser extent species diversity.

Water birds on the Sefton SSSI from Crosby Shore to Southport Pier have declined in numbers by 40% over the past 10 years but further work is needed to see if these losses have been compensated for on the Ribble SSSI." More information on the birds of the Sefton Coast can be found in White (2010).

Woodlands on the coast will be considered by Mersey Forest in the context of adaptation to coastal change. A recent report produced through the green infrastructure strand of the Northwest Climate Change Action Plan, part of the EU funded 'Green and Blue Space Adaptation for Urban Areas and Eco Towns (GRaBS)' project, builds upon a report from 2008 on 'Critical climate change functions of green infrastructure for sustainable economic development in the Northwest'.

The report sets out how and where green infrastructure can help the Northwest to mitigate and adapt to climate change. It is intended to raise awareness in the Northwest of the climate change services that green infrastructure can provide, and to start to target where these may be considered to be the most important; highlighting that it may be possible to get multiple services from the same piece of land and the need to take opportunities as they arise to do this. Indeed, green infrastructure can be seen as a 'win-win' solution as it can also deliver multiple other benefits whilst combating climate change. The full report can be found at [http://www.greeninfrastructurenw.co.uk/resources/GI How & where can it help the NW mitigate and adapt to climate change.pdf](http://www.greeninfrastructurenw.co.uk/resources/GI_How_&_where_can_it_help_the_NW_mitigate_and_adapt_to_climate_change.pdf). It is hoped that this report will feed into the Sefton Coast Woodland Forest Plan which will be reviewed as part of the Landscape Partnership Scheme.

Saltmarsh was not considered to be at risk as current accretion rates exceed sea level rise (see report by Holden V.J.C. (2008)) on the evolution of the Ribble Estuary at <http://www.sefton.gov.uk/default.aspx?page=4730>) and the Ribble Estuary is expected to continue prograding (at the time of writing a report on the Cell 11 Tide and Sediment Study is being completed and includes an appendix considering the future evolution of estuaries in the North West of England, this will be published by the North West and North Wales Coastal Group). However continued monitoring is essential to confirm the expected response of the Saltmarsh.

The key identified risk area was the fixed sand dune habitat around Formby Point where over the next 100 years there is expected to be a loss of 260 hectares of specialised habitat (Newton, 2009) and the fragmentation of fixed dune habitats north and south of Formby point.

Tourism, leisure and recreation

Two different but complementary aspects of coastal tourism are evident in Sefton; the seaside resort town of Southport with its associated bathing beaches; and the wider countryside of pinewoods, dunes, marshes and quiet beaches.

The area is internationally important for its rare species of wildlife including Natterjack Toads and Sand Lizards and has over 300 different recorded bird species. These species are important in both attracting visitors to the coast, and for raising awareness of the uniqueness and importance of the coastline.

Looking to the future coastal change presents both opportunities and constraints; hotter drier summers in the UK combined with excessive temperatures in traditional destinations such as the Mediterranean have the potential to increase tourist numbers. The constraints relate to the limits in relation to access, car parking and the condition and extent of the habitat that attracts a specialist sector of the visitors.

The Sefton Coast as a popular tourist destination also supports a large number of coastal car parks, caravan sites, holiday complexes and a large

number of leisure and recreational amenities with a sailing club, rifle range and internationally famous golf courses all within the coastal zone.

Agriculture

The area includes a mixture of agriculture, ranging from open marshes grazed by sheep, areas of reclaimed pasture and enclosed fields supporting dairy or beef cattle and some arable farming such as asparagus farming on the sandy soils.

The principal impacts on agriculture are likely to be from climate change rather than coastal change and relate to changes in growing conditions.

Infrastructure and development

The Sefton Coast is supported by a comprehensive network of rail, roads, footpaths, cycling routes and sewerage network. The Sefton Coast also has the River Alt and Crossens channel that drain from the land into the sea; both are heavily pumped by a series of pumping stations. There are also two marine lakes on the coast at Southport and Crosby which are re-filled with saline water from the sea on the highest tides via sluice gates. The Sefton Coast is also home to a major port, The Port of Liverpool, which contributes to the economic development of Sefton supporting 200 port related businesses and employing 3,500 people. At Seaforth docks there is also a newly built ferry terminal bringing visitors to the Liverpool area from Dublin. Other areas of development within the coastal zone are offshore wind farms, offshore oil and gas exploration, sewerage infrastructure and a telecommunication gateway for the Atlantic region.

Risk to infrastructure relates to changes in the position of the coast and changes in the likelihood of tidal flooding, these changes can result from ongoing coastal change or sea-level-rise associated with climate change or a combination of both. Where hard defences are robust there is a risk that they will overtop more frequently, where defences are towards the end of their useful life there is a risk that they will fail. Where there are sand dunes as a

natural coastal defence the risk to infrastructure relates to the sand dunes rolling back due to erosion and the asset being lost to the sea.

Archaeology

The archaeology of the Sefton Coast consists of finite and irreplaceable resources, often fragile and subject to natural and human forces. The coastal area encompasses an environment which offers high potential for the preservation in situ of the most important archaeological sites, structures and remains. The Sefton Coast is of proven archaeological potential and represents one of the richest areas for prehistoric settlement and activity in the lowland north west. For more information on the presence of human and animal footprints and artefacts in the intertidal Holocene deposits of Formby and Hightown see Lewis (2010).

In the future the principal risk to archaeology is the same as it is now, through exposure and loss to the sea. Conversely this also leads to discovery of new features.

Industry

The Sefton Coast includes the Port of Liverpool which is a major industry/employer within Sefton, alongside smaller industries such as fishing. There are also the tourism, leisure and recreation industries which are supported by the Sefton Coast such as bird watching, cycling, walking and wind sports such as kite surfing. More information on marketing the Sefton Coast can be found in Sandman (2010).

Features such as the Port are robust in their design and unlikely to suffer adverse impacts from coastal change. Other industries such as fishing are more vulnerable due to their reliance on a natural system that might be impacted by coastal change even if it is only to migrate further north as temperatures change.

People

The Sefton Coast is home to a population of 282,958 people as of the 2001 census. 5 million people live within an hour's drive of the coast; it is popular with a wide variety of visitors looking for different experiences. The most recent research on visitors to the Sefton Coast (excluding Southport) is from 2006 (Sefton's Natural Coast Research 2006). This found that people were visiting the Sefton Coast for - walking, exercise, dog walking, bike/horse riding, and nature. Half of these visitors were local, living in the Sefton area. The other visitors comprised day visitors from other areas of Merseyside, or holidaymakers from further afield, of which half had been attracted to Sefton because of the Coast.

People can be very resistant to change, as we go forward and try to adapt to coastal change this will become increasingly significant if people are not kept informed and understand why actions need to be taken. There are many local people who value the coast, who have the potential to assist or block action; they also have a role in mitigation. There will be some people who are directly impacted by coastal change and climate change such as those using coastal infrastructure like car parks and caravan sites.

Way Forward

Nature conservation

Following on from a workshop with Partners on the Sefton Coast it was agreed that coastal change was an issue for the nature conservation value of the Sefton Coast and that approaches for adaptation need to be embedded within the Nature Conservation Strategy. The Nature Conservation Task Group will take this action forward.

There will be further research in relation to sand dunes, intertidal areas and areas of accretion, taken forward by the Council's Coastal Defence Team who will also commission the development of a Wetlands Strategy that will include consideration of dune slacks.

Tourism, leisure and recreation

Whilst issues and opportunities were identified in relation to this topic area there was no clear ownership from any person or group to take this forward. The Coastal Defence Team will continue to raise awareness of this issue and encourage ownership from the relevant organisations.

Agriculture

Given that this topic area is predominantly impacted by climate change it is appropriate for it to be considered by the Council wide Adaptation to Climate Change Strategy.

Infrastructure and Development

Significant elements of the risk to be managed are already covered by Shoreline Management Plans or Catchment Management Plans both of which take into account coastal change and climate change; these plans are developed and implemented by the Environment Agency and the Council.

Technical advice is provided by the Coastal Defence Team in relation to coastal erosion and in particular advice will be provided for both the National Trust in relation to their car park and the caravan site at Freshfield.

Hightown and the Blundellsands sailing club are at risk from coastal flooding but this risk is being managed through proposals for defences in this area being promoted by the Coastal Defence Team.

Any future developments such as Ocean Parks, will be required to undertake an assessment that will include the implications of coastal change.

Archaeology

Issues from this area can be taken forward by the Archaeology and History Task Group. There may also be opportunities for improved recording through the Landscape Partnership Project.

Industry

It would be expected that any issues relating to fishing would be taken up by the North West Sea Fisheries Committee but this will be confirmed by letter. There were no issues identified in relation to the Port of Liverpool.

People

Given the continual need to raise people's awareness of the issues around adaptation to coastal change a communications plan will be developed that sets out a coordinated high level approach as well as addressing some short term site specific issues. The Coastal Defence Team will lead on this using a funding contribution from Natural England.

Monitoring, Review and Supporting Implementation

The above sets out some of the short term actions that are required as part of our approach to adaptation to coastal change; all of these relate to strategies or plans and the need for these to embed adaptation to coastal change within them. As such the monitoring and review of the detailed actions should be taken forward as part of these strategies and plans with any monitoring and review following on from this study relating to checking that the adaptation approach has been adopted. Given that the emphasis is on adoption of the approach to adaptation there will be a need for continued support on how this can be done until such time as it is common practice; the Coastal Defence team will provide that support.

References and further reading

DEFRA (2009) Consultation on coastal change policy

<http://www.defra.gov.uk/corporate/consult/coastal-change/consultation-doc.pdf>.

Holden, V. J. C. (2008) Report on the evolution of the Ribble Estuary, with particular reference to the north Sefton Coast

<http://www.sefton.gov.uk/default.aspx?page=4730>

IPCC (2001) *Climate Change 2001: Impacts, Adaptation, and vulnerability*. Cambridge University Press, Cambridge.

Lewis, J. M. (2010) Archaeology and history of a changing coastline In: *Sefton's Dynamic Coast: proceedings of the conference on coastal geomorphology, biogeography and management 2008*. Worsley, A. T., Lymbery, G. Holden, V.J.C. and Newton, M (eds) Coastal Defence: Sefton MBC Technical Services

Newton, M. (2009) Adaptation to coastal change as a result of climate change, in particular sea level rise and its impact upon habitat extents into the future, using the Sefton Coast as a case study site. Sefton MBC, Southport.

Northwest climate change action plan and GRaBS project (2010) Green Infrastructure: How and where can it help the northwest mitigate and adapt to climate change?

[http://www.greeninfrastructurenw.co.uk/resources/GI How & where can it help the NW mitigate and adapt to climate change.pdf](http://www.greeninfrastructurenw.co.uk/resources/GI_How_%26_where_can_it_help_the_NW_mitigate_and_adapt_to_climate_change.pdf).

Sandman, P. (2010) Marketing Sefton's natural coast – Evaluating the impact In: *Sefton's Dynamic Coast: proceedings of the conference on coastal geomorphology, biogeography and management 2008*. Worsley, A. T., Lymbery, G. Holden, V.J.C. and Newton, M (eds) Coastal Defence: Sefton MBC Technical Services

White, S. (2010) The birds of the Sefton Coast: A review In: *Sefton's Dynamic Coast: proceedings of the conference on coastal geomorphology, biogeography and management 2008*. Worsley, A. T., Lymbery, G. Holden, V.J.C. and Newton, M (eds) Coastal Defence: Sefton MBC Technical Services

DRAFT

Appendix

Adaptation approach on the Sefton Coast

Through a process of risk management, important features within these key themes were looked at in more detail in terms of:

- what is at risk from coastal change and climate change
- what is the importance of that feature
- what would be the significance of change to this feature
- what is the priority score of this feature in terms of risk and significance

Key actions are listed which are needed to ensure we are adapting to potential change and realistically aiming to reach our vision of the Sefton Coast. Opportunities arising from coastal change and climate change are also highlighted in each table below.

Risk assessment

In order to prioritise the risk of features to the possible threats of coastal change and climate change a subjective risk assessment has been undertaken to determine a priority rank of features at risk. Low, medium and high are converted to a numeric value by assigning 1, 2 and 3 to them; the overall risk is scored by multiplying the values for likelihood and significance together. This process provides a method of prioritising and the numeric value has no meaning other than this.


Where risk is already being managed through strategies such as Shoreline Management Plans the risk has been assessed as if these were not in place. This serves to recognise the importance of these strategies and ensure that their implementation is not overlooked or given a lower priority.


Likelihood of risk	High	3	6	9
	Medium	2	4	6
	Low	1	2	3
		Low	Medium	High
Significance of risk				


Risk Factor	Priority Rank
6 to 9	High
1 to 4	Low


R	More research is needed to fully asses the potential risk to coastal change including climate change
----------	--

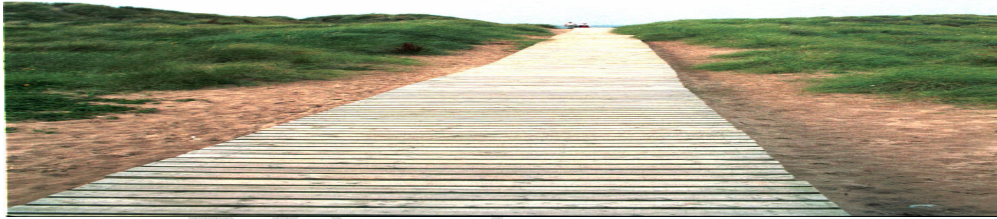
A full detailed analysis of the risk assessment can be found below:


Title Nature conservation		
Sub title Sand dunes		
Likelihood Mobile sand dunes will adapt to coastal change as long as there is nothing to impede their roll back. Threats to this natural process are where there are features which may impede the natural roll back of the dunes or where the sand feed from the beach is interrupted due to, for example, local drainage features. This assessment is yet to be done although erosion has been evidenced for years.	Significance The coastal habitats are designated under the European habitat designations and in Sefton we have 20% of the sand dune system in England.	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity To manage the system to ensure diversity of habitats. Further investigation will ensure awareness of habitats and processes.		
Adaptive option This action will be progressed by the Coastal Defence Team under the IMCORE project. Research will be undertaken to improve our predictions of future coastal change not only in terms of position but also the geomorphological form that the change will take.		


Title Infrastructure and development, people, tourism, Leisure and recreation		
Sub title Amenities		
Likelihood Tidal flooding of shops is controlled by coastal defence structures and floor slab level. The current level of sea defence at Southport is 1 in 20 year. Provisions have been made in the design to allow for an increase in height of the defence in future if required.	Significance Risk to high value amenity infrastructure of overtopping of sea walls is low. The infrastructure would not be impacted upon but the access infrastructure would be leading to potential for loss of trading whilst access is difficult.	
Score explanation Based on anticipated overtopping of defences once every 20 years the likelihood is medium.	Score explanation Significance is low as there will only be loss of trading for a limited time with no damage to buildings.	
Likelihood of risk score: 2	Magnitude of significance score: 1	Total risk factor: 2
Opportunity		
Adaptive option There is a long term option of increasing the defences, but the amenity value of the sea wall may be decreased in doing so.		


Title Agriculture		
Sub title Crops		
Likelihood Many of the anticipated effects of climate change are likely to change the availability of food either grown locally or imported. It is therefore appropriate to consider what these effects are likely to be and adapt in a positive manner to secure food supply. It is possible current foodstuffs might become less available/viable to farm leading to shortages especially if crops totally fail. Also opportunities may exist to produce food more resilient to the future climate.	Significance This will be taken forward at a Council level and requires further research/information	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity		
Adaptive option		
To be dealt with within the broader Council strategy.		


Title Agriculture		
Sub title Grazing		
Likelihood Some of the issues as for crops will apply but there are specific issues related to grazing on the salt marsh due to both sea level rise and the ability of the salt marsh to adapt with changing weather patterns.	Significance Reduced extent of salt marsh to graze	
Score explanation Current accretion rates on the salt marsh exceed the predicted sea level rise rates for the next 50 years. However with increasing sea levels and changing climatic factors there may be changes in plant species composition that may have implications for grazing.	Score explanation Grazing can be relocated	
Likelihood of risk score: 2	Magnitude of significance score: 1	Total risk factor: 2
Opportunity		
Adaptive option		


Title		
Infrastructure and development, people, tourism, leisure and recreation		
Sub title		
Access to or along the coast (footpaths, work access, vehicular access to other infrastructure)		
Likelihood	Significance	
Access is likely to be affected by sea level rise and blown sand particularly on the eroding section of coast. Access could also become blocked due to flooding in extreme rainfall and storm events	Loss of or closure of access routes used by workers and visitors to the coast	
Score explanation	Score explanation	
Access to a changing coast is inherently difficult to maintain and will require ongoing management.	Loss of or closure of access routes whilst not considered critical is significant in relation to public use of the coast and costs associated with maintenance.	
Likelihood of risk score: 3	Magnitude of significance score: 2	Total risk factor: 6
Opportunity		
There will be opportunities to interpret this change to raise awareness amongst stakeholders.		
Adaptive option		
Use predictions of coastal change and day to day experience to identify areas requiring management. Consider if anticipatory actions are required and plan for accordingly. Consider future change in the design of access.		


Title		
Infrastructure and development		
Sub title		
Pumping Stations - River Alt and Crossens channel		
Likelihood	Significance	
Pumping stations will need to cope with changing rainfall patterns and pumping out against higher sea levels.	The pumping stations provide a key aspect of flood risk management to a large area of Sefton.	
Score explanation	Score explanation	
Studies indicate impacts arising from changes in precipitation patterns	Protection of life and property	
Likelihood of risk score: 3	Magnitude of significance score: 3	Total risk factor: 9
Opportunity		
Adaptive option		
This risk is being actively managed by the Environment Agency through Catchment Flood Management Plans.		


Title		
Infrastructure and development		
Sub title		
Sewerage		
Likelihood	Significance	
Warmer wetter winters and extreme events such as floods are likely to impact upon sewerage systems functionality and capacity. Mersey Estuary pollution Alleviation Scheme infrastructure is located in the coastal erosion risk zone at Crosby and with sea level rise this will be under significant threat.	Failure of sewage systems due to flooding or erosion will lead to the release of sewage with both social and economic implications.	
Score explanation	Score explanation	
Without action coastal erosion will impact on these assets based on recent studies	High impact upon communities, business and well being with large emotional and economic implications	
Likelihood of risk score: 3	Magnitude of significance score: 3	Total risk factor: 9
Opportunity		
Adaptive option		
This risk is being actively managed by the Council in liaison with united utilities through Shoreline Management Plans that take into account coastal change and climate change when developing policies for short (0-20 years), medium (20-50 years) and long (50-100 year) term epochs.		


Title		
Infrastructure and development		
Sub title		
Roads		
Likelihood	Significance	
A combination of hotter summers and wetter winters compounding the effects of rutting, potholes and road collapse. Increased frequency of flooding between Weld Road and the Esplanade.	Severely delayed trips and distribution to commuters, increased economic burden on road maintenance budgets.	
Score explanation	Score explanation	
Considering coastal aspects only (wider issues will be dealt with by the Council wide strategy); there will be an increased risk of temporary or permanent loss of road infrastructure at the coast.	Alternative routes are available but there would be costs associated with any diversions.	
Likelihood of risk score: 3	Magnitude of significance score: 2	Total risk factor: 6
Opportunity		
Adaptive option		
This risk is being actively managed by the Council through Shoreline Management Plans that take into account coastal change and climate change when developing policies for short (0-20 years), medium (20-50 years) and long (50-100 year) term epochs.		

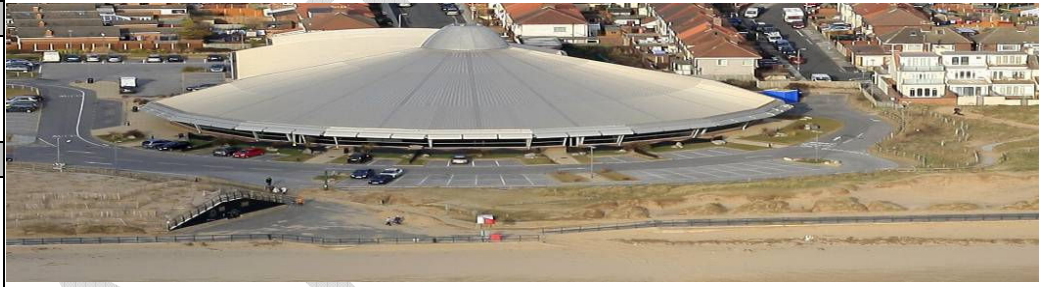
Title		
Infrastructure and development		
Sub title		
Telecommunication cables which run under the sea from the Atlantic		
Likelihood	Significance	
Location is at Ainsdale, this area is currently accreting and an assessment has yet to be made of Sea level rise on this section of coast	Need to refer to operator to assess the significance	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity		
Adaptive option		
No urgent action required but when there is a better understanding of the future evolution of this length of coast the action should be reviewed. An improved understanding is likely to be developed by assessments required for the development of the adjacent holiday camp which is due to be redeveloped in the near future.		

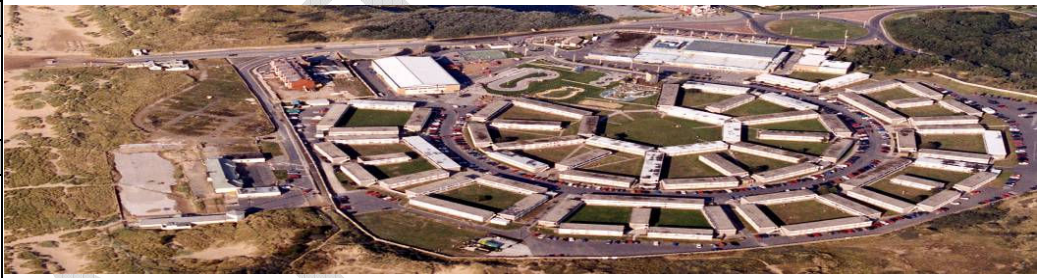
Title Infrastructure and development		
Sub title Railways		
Likelihood Low risk from coastal erosion and flooding. Damage from other climate change impacts would need to be an issue for the maintainer of the railway.	Significance Economic loss associated with tourism and commuting.	
Score explanation Low risk as studies have been undertaken to asses flood and coastal erosion in this area	Score explanation Key transport link	
Likelihood of risk score: 1	Magnitude of significance score: 3	Total risk factor: 3
Opportunity		
Adaptive option		


Title		
Infrastructure and development and people		
Sub title		
Houses		
Likelihood	Significance	
Without appropriate coastal defence there will be a higher risk of losing homes due to erosion and flooding of homes if these were not in place.	Loss of homes affects the social well being of communities and the local economy. Home insurance may go up in price in areas most at risk.	
Score explanation	Score explanation	
Based on assumption of no replacement of or improvement to defences houses will be lost in the short to medium term (20-50 years) due to coastal erosion and suffer from increased flood risk.	High emotional and economic significance to residents close to the sea and in flood prone areas	
Likelihood of risk score: 3	Magnitude of significance score: 3	Total risk factor: 9
Opportunity		
Adaptive option		
This risk is being actively managed by the Council through Shoreline Management Plans that take into account coastal change and climate change when developing policies for short (0-20 years), medium (20-50 years) and long (50-100 year) term epochs.		


<p>Title</p> <p>Infrastructure and development, people, tourism, leisure and recreation</p>		
<p>Sub title</p> <p>Car Parks</p>		
<p>Likelihood</p> <p>Predicted sea level rise on the Sefton Coast will threaten car parks, especially those located close to the eroding soft coast providing parking for beach visitors.</p>	<p>Significance</p> <p>Impact upon tourism and traffic congestion. Cost associated with clean up of debris from car parks when exposed on the beach due to erosion. Costs associated with provision of alternative facilities or loss of income and disruption if no alternative provided.</p>	
<p>Score explanation</p> <p>High confidence that erosion will continue and rates will increase due to sea level rise</p>	<p>Score explanation</p> <p>Wider community impacts due to loss of car park. Economic impact upon land owner.</p>	
<p>Likelihood of risk score: 3</p>	<p>Magnitude of significance score: 3</p>	<p>Total risk factor: 9</p>
<p>Opportunity</p> <p>Opportunity to design new facilities in such a way that they anticipate the need for removal in the future.</p>		
<p>Adaptive option</p> <p>A study is underway for the car park at Victoria Road which will detail the nature of the foundation material; state how much will need to be removed from site and detail options for the restoration of sand dunes over the car park area using the residual material. This is being taken forward by the Coastal Defence team.</p>		


Title		
Infrastructure and development, people, tourism leisure and recreation		
Sub title		
Caravan Sites		
Likelihood	Significance	
Within the current predictions of erosion with sea level rise there is one caravan site wholly within the area of erosion risk and one site on the fringes of erosion which it is expected will be inundated by blown sand as the coast erodes back.	Will have impact upon the local economy through loss of tourism and impact to residents of caravan sites. Economic impacts upon operators.	
Score explanation	Score explanation	
High confidence that erosion will continue and rates will increase due to sea level rise	Impact upon the local economy is low but the emotional impact to residents is potentially high.	
Likelihood of risk score: 3	Magnitude of significance score: 2	Total risk factor: 6
Opportunity		
Adaptive option		
The northern caravan site at Formby Point will be approached to see if they understand the risks and ascertain what support might be required.		

Title Infrastructure and development, people, tourism, leisure and recreation		
Sub title Leisure centres		
Likelihood Likelihood of damage occurring to leisure centre at Crosby without works to take into account climate change would be high in the long term due to sea level rise.	Significance Loss of high value infrastructure.	
Score explanation With no active intervention the risk is considered to be high.	Score explanation Significance is high as it is a high value amenity that could be lost to coastal erosion	
Likelihood of risk score: 3	Magnitude of significance score: 3	Total risk factor: 9
Opportunity		
Adaptive option This risk is being actively managed by the Council through Shoreline Management Plans that take into account coastal change and climate change when developing policies for short (0-20 years), medium (20-50 years) and long (50-100 year) term epochs.		

Title Infrastructure and development, people, tourism, leisure and recreation		
Sub title Pontins Holiday Camp		
Likelihood Location is at Ainsdale where this area is currently accreting and an assessment has yet to be made of the impacts of coastal change and climate change on this section of coast	Significance Significant in terms of local economy in relation to tourism and construction works associated with re-development.	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity		
Adaptive option As part of the redevelopment proposals the site owners will need to undertake an assessment of future coastal change for this area. This will inform future decisions.		

Title		
Industry, people, tourism, leisure and recreation		
Sub title		
Docks		
Likelihood	Significance	
Docks may be adversely affected by sea level rise.	<p>There are two potential impacts on the docks from sea level rise, the first being the operation of the docks and the second being coastal erosion and flooding. With respect to the operation sea level rise will not impact upon the docks due to the lock system currently in place which controls the water levels within the docks and the new Seaforth triangle development would allow for sea level rise as it is an in river development. In relation to coastal erosion and flooding the exposure is low and any changes required can be added onto any existing structures.</p>	
Score explanation	Score explanation	
There is high confidence in relation to sea level rise occurring	Potential impacts are currently manageable	
Likelihood of risk score: 3	Magnitude of significance score: 1	Total risk factor: 3
Opportunity		
Adaptive option		

Title		
Industry, people		
Sub title		
Fishing		
Likelihood	Significance	
Needs more information from local experts and / or research to ascertain likelihood	Needs more information from local experts and / or research to ascertain significance	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity		
Adaptive option		

Title		
Nature conservation		
Sub title		
Birds		
Likelihood	Significance	
<p>The timing of birds' migration, reproduction, breeding, nesting, and hatching are all highly adapted to match specific local conditions, such as the availability of suitable habitat and adequate food sources. Since climate change will affect different species differently, bird behaviour may no longer be in sync with their food sources and other habitat needs. To compensate for warmer temperatures, birds may move closer to the poles or higher elevations.</p>	<p>Comments sought from experts (comments in main report) and risk score based on their comments.</p>	
Score explanation	Score explanation	
Likelihood of risk score: 2	Magnitude of significance score: 2	Total risk factor: 4
Opportunity		
Adaptive option		

Title
Archaeology
Sub title



Footprints, submerged forest and track ways

Likelihood	Significance	
Coastal erosion has revealed the sub-fossil footprints of animals, birds and humans in Holocene sediments at Formby Point. There is also the submerged forest and track ways at Hightown which are of significant historical and archaeological importance. Climate change is expected to result in an acceleration of current rates of sea level rise which will intensify the current rate of coastal erosion at Formby Point.	There is a possibility that sea-level changes may uncover further archaeological features elsewhere across the foreshore and intertidal sediment outcrops which tend to pass unnoticed. However, once exposed, such strata are immediately subjected to the destructive forces of the tides and longshore currents and any palaeoenvironmental and archaeological evidence they may contain is lost for ever.	
Score explanation	Score explanation	
Erosion is already happening at Formby and the submerged forest at Hightown is already exposed. It is anticipated that the erosion will continue into the future.	Given that the loss is already occurring it is assumed that an appropriate response is already in place.	
Likelihood of risk score: 3	Magnitude of significance score: 1	Total risk factor: 3
Opportunity		
For new archaeological evidence to be uncovered.		
Adaptive option		
To ensure thorough system of identifying and recording new archaeological evidence in place before they are eroded.		

Title
Nature conservation
Sub title



Intertidal


Likelihood	Significance	
Recent national studies suggest a steepening of the coast resulting in a reduced intertidal area but this has yet to be made more locally specific.	This could have important implications for organisms that depend on these sites, including shorebirds that rely on them for foraging habitat during their migrations and in winter. As the area of feeding habitat is reduced, densities of shorebirds increase, and density-dependent interactions may be triggered, resulting in the exclusion of individuals from the site, increased mortality rates among the excluded birds, and, ultimately, in limitation of numbers. Could impact upon coastal processes increasing exposure to storm events.	
Score explanation	Score explanation	
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R
Opportunity		
Adaptive option		
There will be continued monitoring of beach areas in relation to topography and extent to inform future analysis.		


Title
Nature conservation
Sub title



Fixed Habitats


Likelihood	Significance	
The Sefton Coast and its habitats are extremely vulnerable to climate change, in particular sea level rise. As the coast is eroded it is anticipated that the mobile dune system will migrate in land. It is predicted that approximately 260 hectares of fixed habitats could be lost over the next 100 years with major losses to ruderal and ephemeral habitats (62%), semi fixed dunes (39%), fixed dunes (34%), woodland (31%) and dune slacks (18%) based on the total areas of habitats located on the eroding section of the coast. Coastal squeeze at Formby Point will also lead to a significant fragmentation of the continuity of fixed dune habitats to the north and south, putting many habitat dependent species at risk. Whilst studies have been undertaken on the eroding section, the accreting section of coast needs to be investigated to calculate any net gains in habitats. Warmer wetter winters and hotter drier summers are likely to see changes in ground water levels and changes in the viability of habitats on this coast.	The coastal habitats are designated under the European habitat designations	
Score explanation	Score explanation	
Based on recent studies	Importance at a European level	
Likelihood of risk score:3	Magnitude of significance score: 3	Total risk factor: 9
Opportunity		
There are areas on the coast that are accreting with consequent gain in habitat but these areas require further research to quantify this gain and better understand how long the accretion will continue for.		
Adaptive option		
Wetlands (dune slacks) - for this habitat a study will be commissioned that will consider wetlands across the Sefton coast over a hundred year period but developing an action plan for a ten year period.		

Title				
Nature conservation				
Sub title				
Woodlands				
Likelihood Current CO ² concentrations are not optimum for photosynthesis and further CO ² emissions would enhance growth rates assuming all other environmental issues remain constant. Rising levels of CO ² is also expected to lead to hotter summers followed by warmer and wetter winters.	Significance Bud burst is likely to occur earlier due to rising winter temperatures. The wetter winters are likely to increase water logging and reduce tree stability. Hotter summers are likely to lead to longer periods of drought stress			
Score explanation	Score explanation			
Likelihood of risk score:	Magnitude of significance score:	Total risk factor: R		
Opportunity				
Adaptive option				
Adaptation is in the process of being embedded in the appropriate plans and strategies by the appropriate organisations.				

Title	Nature conservation	
Sub title	Salt Marsh	
Likelihood	Significance	
The construction of the coast road sea wall at Marshside during 1960 and 1970 has implications in relation to coastal squeeze, restricting the opportunity for landward migration of the Salt marsh if sea level rise is occurring at a rate which the salt marsh cannot keep pace	The saltmarsh provides protection from overtopping as it dissipates wave energy. Loss of this natural coastal defence would leave Southport at increased risk from tidal inundation and may require an extension to the height of the sea wall to neutralise the threat. In addition to providing a natural sea defence the brackish marshes are an important RSPB nature reserve.	
Score explanation	Score explanation	
Recent studies suggest the salt marsh is keeping pace with sea level rise in the Ribble area.	Important for coastal defence and over wintering birds	
Likelihood of risk score: 1	Magnitude of significance score: 3	Total risk factor: 3
Opportunity	There is an opportunity to consider the broader value of this habitat particularly as a CO2 sink.	
Adaptive option	There is a need to continue to improve our understanding of this environment and associated sediment movement so that we can review the risk in the future.	

Title	Infrastructure and development, people	
Sub title	Blundellsands Sailing Club	
Likelihood	Significance	
The Blundellsands sailing club is protected by informal defences. To the north and south of the sailing club there is erosion. The defences are in a poor condition and with no intervention the sailing club would be lost to erosion in the future.	Important aspect of the local community and is valuable as a launching point on the coast.	
Score explanation	Score explanation	
Assessments have been undertaken on the future evolution of this section of coast without intervention	Important at a local community level	
Likelihood of risk score: 3	Magnitude of significance score: 2	Total risk factor: 6
Opportunity	Benefit to local environment.	
Adaptive option	The rebuilding of the sailing club defences will form part of a wider project of coastal management that will benefit habitats and provide erosion protection to Hightown through the restoration of sand dunes in this area.	



Title		
Infrastructure and development, people, tourism, leisure and recreation		
Sub title		
Rifle Range		
Likelihood	Significance	
Sea level rise increases the rate of coastal erosion and the risk of tidal inundation. However, the Rifle Range is located on an accreting stretch of coastline and is protected by natural sand dunes which will roll back in the event of increased coastal erosion.	Areas of the Rifle Range maybe lost under migrating sand dunes with some areas prone to tidal inundation. This may result in the relocation of the facility to another county which will result in the loss of a public amenity and relocation of jobs.	
Score explanation	Score explanation	
Erosion studies have been undertaken for this section of coastline and indicate no risk over the next 100 years	Important training facility	
Likelihood of risk score: 1	Magnitude of significance score: 2	Total risk factor: 2
Opportunity		
Adaptive option		

Title
Infrastructure and development, people, tourism, leisure and recreation

Sub title
Golf Courses



Likelihood
Most of the Golf Courses on the Sefton Coast are located a short distance inland and whilst providing a links experience are not subject to erosion. Formby Golf Course is the exception to this and has lost land to erosion for a number of years.

Significance
Whilst important to the golf club the change is not significant when considered in the context of available golf courses.

Score explanation
The score applies to Formby Golf Club only

Score explanation

Likelihood of risk score: 3

Magnitude of significance score: 1

Total risk factor: 3

Opportunity

Adaptive option
Formby Golf Club have been adapting to coastal change for some time and are an excellent example of a proactive approach to adaptation.

Through consultation/collaboration a prioritised list of areas which are at risk from climate change and coastal change are:

Feature	Risk score
Rifle Range	2
Amenities	2
Grazing	2
Railways	3
Docks	3
Footprints, submerged forest and track ways	3
Salt Marsh	3
Golf Courses	3
Birds	4
Roads	6
Caravan Sites	6
Blundellsands Sailing Club	6
Access	6
Pumping Stations - River Alt and Crossens channel	9
Sewerage	9
Houses	9
Car Parks	9
Leisure centres	9
Fixed Habitats	9
Sand dunes	R
Crops	R
Telecommunication cables	R
Pontins Holiday Camp	R
Fishing	R
Intertidal	R
Woodlands	R

Summary table of risk assessment