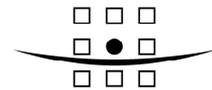


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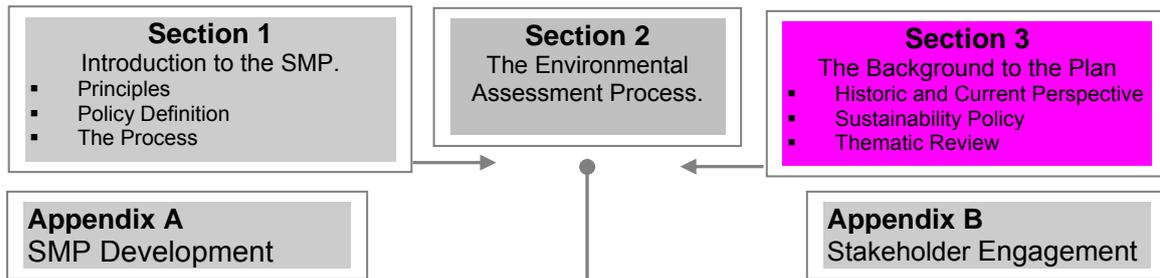
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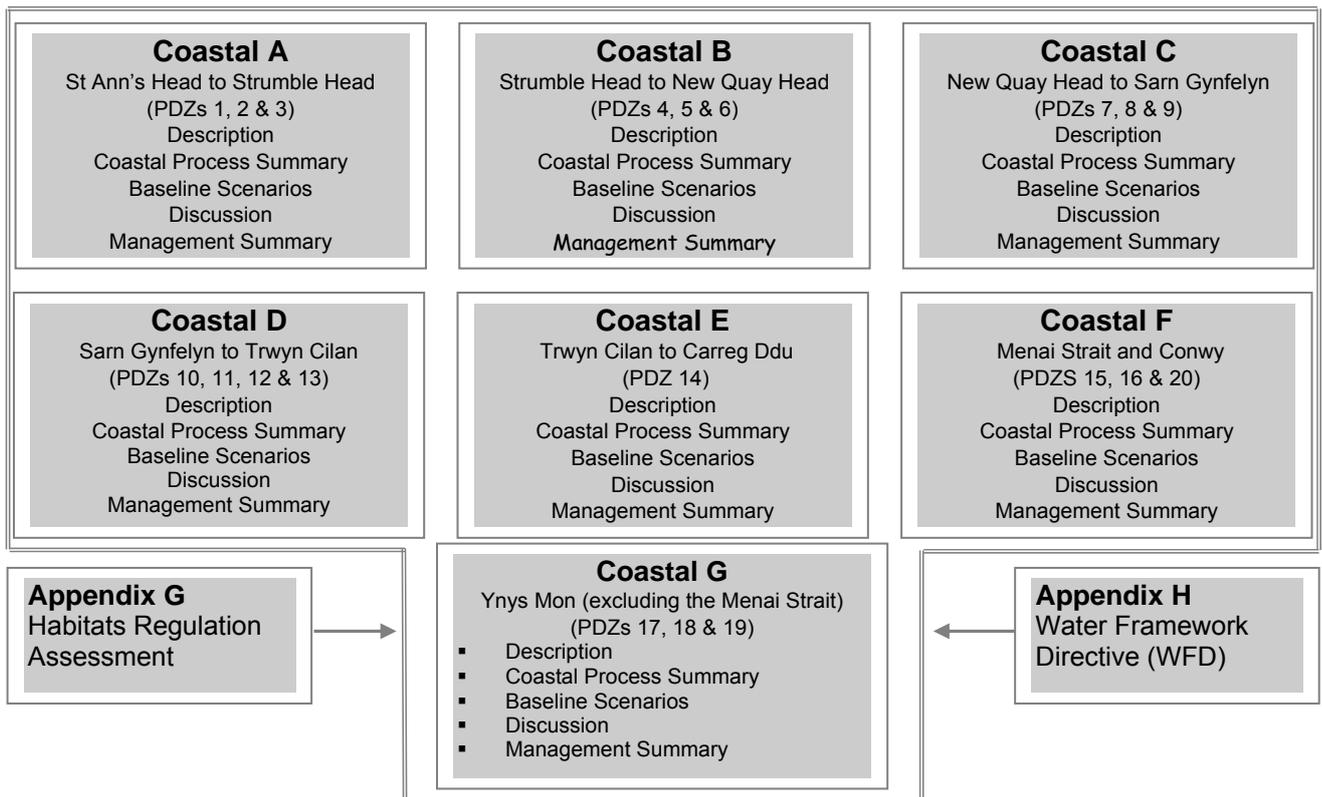
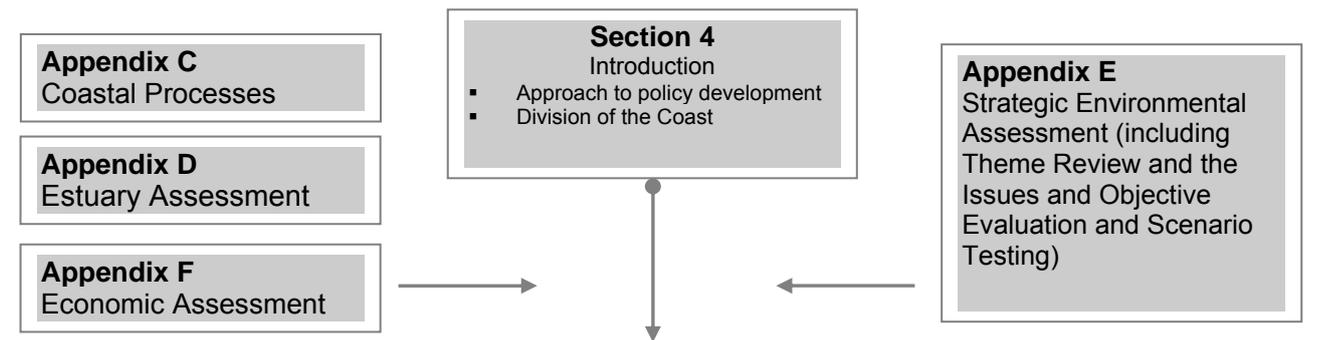
### 3 BACKGROUND TO THE PLAN



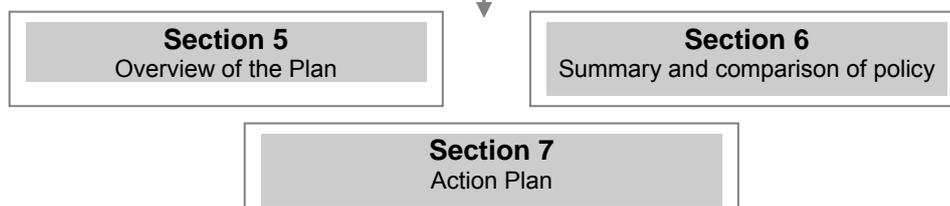
## INTRODUCTION AND PROCESS



## PLAN AND POLICY DEVELOPMENT



## OVERVIEW



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### 3 BASIS FOR DEVELOPMENT OF THE PLAN

#### 3.1 Historical and Current Perspective

##### 3.1.1 Physical Structure

A detailed discussion of the Geology and Coastal processes is presented in Appendix C.

##### Physical structure of the coast and geology

The West coast of Wales is renowned for its spectacular landscape and complex rocky coastline, shaped by the geological processes of the ice age. Additionally, this coastline has provided the evidence for understanding the processes of the Cambrian, Ordovician, Silurian and Carboniferous geological time periods.

The coastline has been formed by the flow and melting of the Irish Sea and Welsh Ice sheets and the more recent marine processes experienced under temperate climates such as a rise in sea levels of some 145m since the end of the last ice age 20,000 years ago. During that ice age, a massive ice sheet covered most of Wales, whilst the Irish Sea ice rested on the bottom of what is now known as the Irish Sea. The Irish Sea ice sheet flowed south and west, past the ranges of hills of the Isle of Anglesey, the Llŷn Peninsula and Pembrokeshire, converging with the westerly flowing Welsh Ice sheet, at the point in Cardigan Bay that is now New Quay. Many glacial features outline the coast of Wales, with the moraine depositions of the three Sarns in Cardigan Bay and by the various carved out, the worn down and the rugged features along the coast determined by the softer or the harder underlying geology.

The geology of Wales can be divided into four different distinct regions; Pembrokeshire, Cardigan Bay, the Northern Mainland and Anglesey. In the south, the harder more resistant bedrock of Pembrokeshire has led to a slower rate of erosion and weathering, giving rise to the rocky coastline. This coast is characterised by bays and headlands created by discontinuities of the variation in rock resistance to the processes acting upon them. Central Cardigan Bay however, is composed of well bedded Ordovician and Silurian shales and sandstones. There are many hard rock features along this coastline and geological features such as Sarns. This central bay experienced a great deal of scour and wearing down when the Welsh ice sheet flowed south west towards the Irish Sea ice. The Northern Mainland is fairly complex in its geology, ranging from Palaeozoic sedimentary rocks to marine mudstones with evidence of volcanoclastic debris. The Llŷn Peninsula can be divided into two different bedrock types; with highly resistant metamorphic rocks found in the west and Ordovician, sedimentary, volcanic and intrusive rocks in the east. The Isle of Anglesey is exceptionally diverse in its geology with rock from most of the major geological eras.

The geology of the Welsh coastline is the strongest control influencing the development of the landscape character which impacts the vegetation cover, drainage patterns, and subsequently the how the local communities interact with the environment.

##### Human and Other Factors

While there are stretches of 'untouched' coastline, man's influence in some areas is quite dominating, with the construction of sea defences, harbour developments and large breakwaters. This impact, although locally quite substantial is limited in larger scale, due to the natural geology determining the shape of the coast.

The erosion of the shoreline is influenced by many factors, most obviously, and particularly over the softer coast by the geomorphology and exposure, and tidal action. Other factors shaping the coast include general weathering, chemical and biological deterioration and groundwater.

### 3.1.2 Physical Processes

#### Wave Climate

The wave climate of a coastal area is determined by the prevailing wind direction, the physical characteristics of the coast and the bathymetry of the sea bed. For the coastline of Wales, the prevailing wind direction is from the west and southwest. The fetch, or distance over the waters surface the wind has to travel, between Wales and Ireland, for westerly winds is limited, restricting the height to which the waves can grow. Typically, waves found along the coast of Wales are generated from the south-westerly winds, blowing for thousands of miles along the surface of the water, creating fairly large swells.

In deeper water, waves aren't affected by the characteristics of the sea bed, however, closer to the shore, the waves interact with the bathymetry as they enter shallower waters, where they experience a process known as shoaling; when waves reduce in length and increase in height. In Cardigan Bay, as waves enter from the southwest into the shallower waters to the east, the waves are slowed down and 'bend' or refract around to enter the bay. Waves in southern Cardigan Bay, entering from the southwest will diffract and shoal around the large rocky headlands of Pembrokeshire, creating a reduced wave energy climate. Further north, this headland provides less protection and waves are more exposed to a greater fetch, moving towards the north east.

#### Tides

Tides entering the Welsh coastline do so in 'long period waves' approaching from the Atlantic Ocean. They pass through the Celtic Sea before reaching St David's Head, moving north along the coast of West Wales. The tide can take up to four hours to pass from the St David's headland up to Anglesey, hence the lag in high tide moving north along the coast. The squeezing effect the Irish Sea has on the tide can influence the height of the tide, for example comparing Aberystwyth and Holyhead, where the sea is narrower in the north, the tidal range is greater.

The tidal dynamics in the Menai Strait have interested oceanographers and researchers for many years. The timing and height differences in the straits are caused by the tidal wave travelling around the north of the Isle of Anglesey coastline and the shape of the strait itself. High tide at the eastern end of the straight is about 1.5m higher than the western end and 1.5m lower at low tide. There is also a lag of approximately 1.5 hrs from high tide at the eastern end following the high tide at the western entrance. The differences in timing and height create very strong currents within the Menai Strait.

#### Water Levels

Many settlements along the Welsh coastline are established at lower topographic levels, relative to the sea. The significance of the water levels (current, storm events and future with sea level rise) will all have a great impact on the sustainability of these coastal communities and ultimately the development of the management intent.

The varying water levels not only pose a risk to the coast as far as flooding is concerned, but can also impact the coastal erosion processes along the shoreline. The SMP has considered the various water levels along the coastline for differing storm return periods. These events have been mapped within the analysis process and used as a basis upon which to assess which properties/ features are at risk of flooding over the epochs based on the present information.

### Future Sea Level Rise

The DEFRA guidance has been followed in the review which includes consideration of the impacts from global warming and sea level rise. Although it is certain that this will occur, the actual rates of sea level rise (SLR) are difficult to predict. Therefore, in order to consider this factor in the development of policy, projections have been made for the UK, and for Wales. The following rates of sea level rise are assumed from the DEFRA guidance issued in 2006:-

To 2025	2025 – 2055	2055 – 2085	2085 – 2115
3.5mm/year	8mm/year	11.5mm/yr	14.5mm/yr

Over the next century, which is the timescale under consideration in this SMP, the total sea level rise anticipated in this table amounts to approximately 1m. In addition, since this guidance is now dated and new research has highlighted the potentially very significant effects of the melting of glaciers in Greenland and Antarctica, we have included the H++ scenario from the United Kingdom Climate Impact Programme 2009 report. This suggests an upper limit value of 2m of sea level rise over the next century. Whilst the probability of this rise actually happening in that timescale is low, it is entirely plausible that such levels could be reached in the following century. It therefore provides a very useful indicator of the extreme and allows the robustness of the SMP to be assessed.

The SMP considers SLR in two different ways. Firstly, we look at the impact of SLR on coastal flooding, mapping the various water levels under differing extreme return periods, to establish the extent of flooding along the coast. Secondly, we look at the influence SLR will have on the erosion of the coast. As water levels rise, certain stretches are exposed to deeper water conditions, meaning waves that are approaching the coast will be larger. These large, higher energy waves attack the shoreline with greater force and cause faster rates of erosion. The coastline is also likely to change as non constrained beaches will roll landwards or if constrained, will be subject to causing coastal squeeze. The beaches may also react to sea level rise in a positive way, by releasing sediment and building the beach. This is the very process which in the past, created many of the Welsh beaches present today.

### Sediment Sources and Supply

In general terms, sediment supply to the shoreline can be derived from a number of ways, either fed from the 'system' by eroding coastlines, deposited from offshore sources or released from rivers and estuaries. The coast of Wales is very diverse in its nature and the sediment fed to and eroded from these stretches of coastline all interacts either in the smaller local scale or on a larger scale.

The harder rocky cliffs of Pembrokeshire release little sediment and therefore contribute to the system only on a local scale, feeding the beaches like Nolton Haven, Broad Haven and Little Haven. In other areas where the rock is softer, greater erosion occurs and feeds longer gravel beaches such as the cliffs of Allt Wen along the Ceredigion coastline, Tan y Bwlch and the southern beaches of Aberystwyth. Till cliffs, when eroded release large amounts of beach building sediment and can contribute to the creation of long sandy beaches such as those found along the southern Llŷn Peninsula. Dunes also form a great source of sediment to the Welsh coastline. The large dune systems of Harlech, Aberdovey and Newborough Warren erode at a very rapid rate and deposit sand into the system and feed local beaches in the nearshore zone over large distances.

The beaches and bays of the coast also receive sediment from offshore sources and accumulate in relatively protected areas such as the Glaslyn estuary and the Menai Straits. The boulder clay layer covering most of the offshore Cardigan and Caernarfon Bay erodes and releases mud and gravel which is sometimes trapped within calm areas. The rivers and estuaries of west Wales also contribute to the sediment supply to the coast; however only in a few areas such as the Dyfi estuary and the Teifi does this occur. Most other estuaries along the coast tend to trap and retain offshore sediment.

Understanding the sediment sources within the SMP is important because it influences the decisions we make about managing the shoreline both now and in the future. Interfering with the natural processes will impact the supply and transportation of sediment and may create problems in the future in terms of the sustainability of beaches, communities, infrastructure and habitats.

### 3.1.3 Natural and Cultural Heritage

#### Heritage

The coast of Wales is rich in its heritage values evident by the historical features as identified in the SMP and considered within the development of the policy. Many of these features, due to the historical nature of Wales, are present close to the coastline. Artefacts, finds and buildings etc have all been identified from prehistoric, Medieval and modern day times (World War II) along the Welsh coast.

Wales is famous for its beautiful World Heritage sites and Historic Parks and Gardens, such as Beaumaris Castle and the Castles and Town Walls of Gwynedd. Many Scheduled Ancient Monuments and Listed Buildings are found in larger settlements and are now tourist attractions such as Conwy Castle and Harlech Castle, and also in smaller villages, adding to the character of the community, for example the listed churches and coastal structures along the Pembrokeshire coast such as St Brides. The nearshore and offshore areas are also rich in history, with heritage coast areas, historic landscapes and protected wrecks.

All of these features contribute to the character of the coast and enhance the value and attraction of an area. It is very important to consider these features in our analysis, not necessarily to protect, but to acknowledge the importance of and to record and preserve the history of the coastline.

### Natural Environment

Wales has an exceptional diversity of habitats and the flora and fauna include many distinctive species. The high quality of the biodiversity along the Welsh coastline is reflected in the high proportion of national, European or internationally recognised sites and/or species that cover large areas of sea and coast.

Protected sites in Wales can be broadly categorised as:

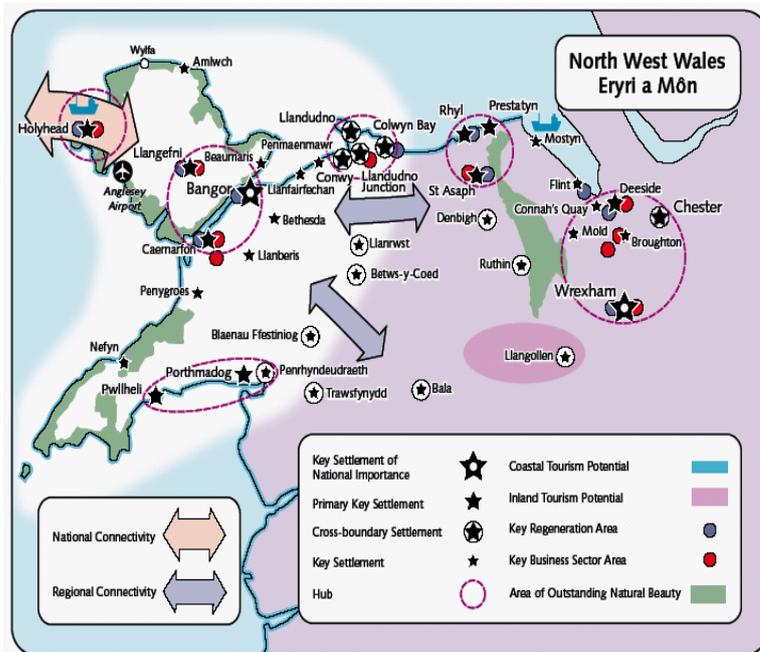
- Special sites protected under UK law - Sites of Special Scientific Interest (SSSIs) and Marine Nature Reserves (MNRs); (160 SSSI's within the study area);
- Natura 2000 sites protected under European Commission Directives – Special Areas of Conservation (SAC) and Special Protected Areas (SPAs); (for example; Cardigan Bay, Great Orme Head and Dyfi estuary);
- Special sites protected under international agreements – Wetlands of International Importance (Ramsar sites), Biosphere Reserves and Biogenetic Reserves; and (for example, Borth Bog and parts of Anglesey), and
- Other special sites – National Nature Reserves (NNRs) and Local Nature Reserves (LNRs). (For example, Ramsey Island, Skomer Island and Bardsey Island).

### Human interaction and use of this coast

The natural geology, the shape of the coast and the natural environment have all determined the development in human terms, of the Welsh coastline. The features and settlements along this coastline are valued for different reasons. Centres of urban economic growth are found at Aberystwyth and Bangor, containing not only local authorities and governmental offices, but large Universities. The major harbours of Fishguard and Holyhead allow for international access into and out of Wales and are a gateway to the United Kingdom and an important link for Ireland to the mainland of Europe. The smaller towns and villages such as Borth, Cardigan and Abersoch provide a base for growing tourism and recreation centres, along with the natural, untouched stretches of coast and beaches used for water sports and hiking. There are, associated with this, many holiday parks and sporting activities such as water sports centres, golf courses and wildfowling, all of which contribute in an important way to the economy. The major transport routes running along the coast include the connecting roads between the smaller settlements and larger centres, and the railway line, running along approximately 180km of the coastline, allowing accessibility to West Wales.

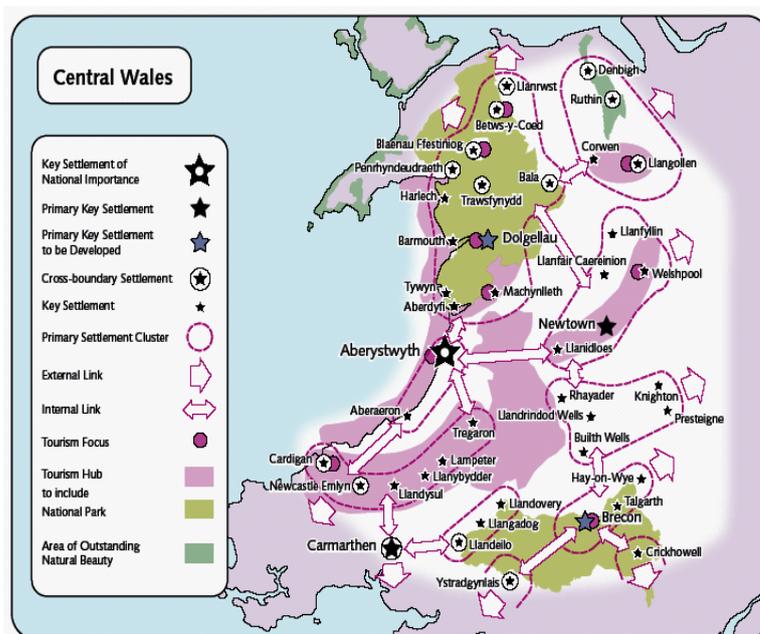
The Wales spatial plan (Figure 3.1) characterises the three main areas of West Wales in the following figures.

*Regional Characterisation.*



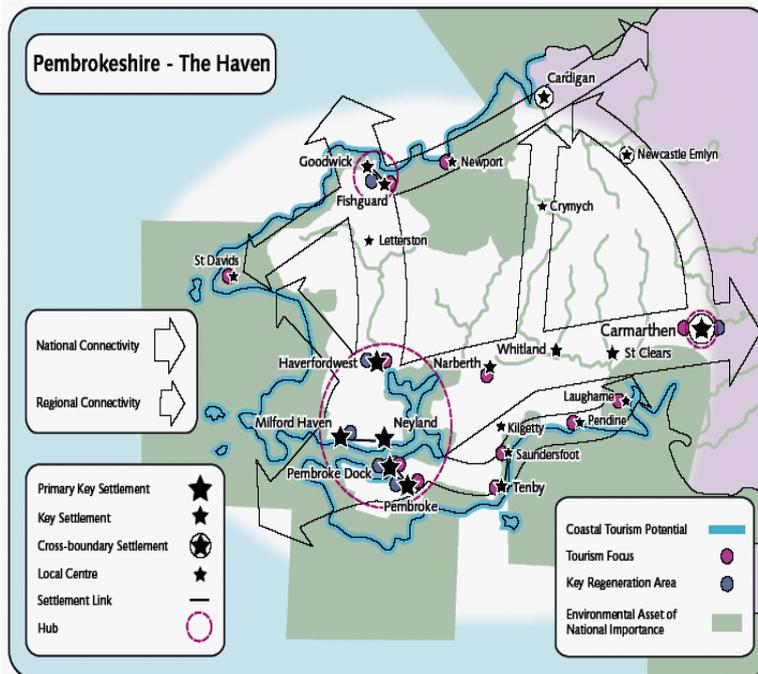
**Figure 3.1 NORTH WEST WALES - ERYRI A MÔN**

\*\*\*An area harnessing the economic drivers on both sides of the border, reducing inequalities and improving the quality of its natural and physical assets'



**Figure 3.2 CENTRAL WALES**

'High-quality living and working in smaller-scale settlements set within a superb environment, providing dynamic models of rural sustainable development, moving all sectors to higher value-added activities'



**Figure 3.3**  
**PEMBROKESHIRE -**  
**THE HAVEN**

*'A network of strong communities supported by a robust, sustainable, diverse high value-adding economy underpinned by the Area's unique environment, maritime access and internationally important energy and tourism opportunities'*

\*\*\*The Conwy,-Llandudno Hub sits across the boundary between regions and this box refers to the core values for the area

### 3.2 The Purpose of the SMP in Relation to the Physical Structure and Processes

The aim of the SMP is to ensure that proper account is taken of the impact or interaction between areas of varying scales, such that management in one area does not have a detrimental impact elsewhere. Typically this implies the need to consider the reliance of defences, erosion rates and cliff stability on secure, high beach levels. From this, and from the broader picture of the potential sediment supply from the nearshore and offshore areas and from erosion of the land, there follows the need to consider the potential sediment pathways, the possible interruption of those pathways and the potential for erosion or retention of sediment. At the same time the SMP has to provide flood and erosion risk policy guidance to a level of information that may feed practically into local planning and management of specific defence lengths. In developing this, therefore, the SMP has to maintain a perspective at a broad level while still addressing local interactions. In terms of the physical processes, the West of Wales SMP coastline exhibits a relatively limited, but still potentially important, linkage across much of the length, within the nearshore area. At the shoreline this general linkage is far more constrained. Therefore, at the same time as taking the high level picture of interaction over the whole coast, many of the more immediately practical issues relate, in some areas, such as Aberystwyth, to quite large but still discrete frontages, and in other areas to very short frontages and local bays.

#### Confidence and Uncertainty

At the broader scale there is, from the data collated as part of the SMP process, a good level of confidence in overall physical evolution of the SMP frontage. However, given the relatively slow rate of natural evolution, further obscured in several areas by the large

scale of change brought about by past activities obscuring the slower natural changes, there is still uncertainty in extrapolating accurately specific rates of erosion at a local level. Equally, despite efforts to better understand the behaviour of the softer coastline, there is still considerable uncertainty associated with the specific degree of erosion or instabilities that may arise.

In terms of a general perspective of the SMP area, therefore, frontages under distinct pressure tend to be of a local nature; but over the broader area there is the requirement for the longer term perspective of 100 years given by the SMP from which to consider significant larger, longer scale change. Further uncertainty exists, both in terms of definition of and in terms of physical response to climate change.

The National Coastal Erosion Risk Mapping (NCERM) system, which provides a national view of erosion, has been updated for this stretch of coastline as an integral part of developing the SMP, in order to gain more clarity of what is likely to happen in terms of the erosion of the coast over the next 100 years. This information was used to evaluate the economic damages. The assessment of economic damage is made using a simplified Modelling Decision Support Framework (MDSF). In the case of erosion, this GIS based tool takes the predicted erosion distance for any section of the coast based on the assessment of erosion by the end of each epoch. It is then taken that there would be a linear erosion rate between these timelines (e.g. a property located midway between the epoch 1 timeline (20 years) and that for epoch 2 (50 years) would be taken as being lost in 35 years). Each property is defined by a single point rather than by its full footprint. No account is taken in the assessment of loss of access or loss of services, although this is discussed in the text where critical. The MDSF method then draws information from a property data base, providing general information with respect to that property. The value of the property is discounted in terms of when that property may be lost.

Although there is confidence that with global warming sea levels will rise, the rate at which this is going to occur is still a great uncertainty among scientists. In order to capture this risk in a realistic manner, we have included the figures given in the Defra guidance (50year scenario 0.36m SLR and 100 year scenario 1m SLR) as well as the UKCP09 high impact scenario projections. This way we have considered a 'worst case scenario' that gives us an indication of the impacts of a potential 2m rise in sea levels, along the coast, whether that occurs in 50 years or 200 years.

### Conclusions

At the broader scale of the SMP coastline and notwithstanding these areas of uncertainty (which relate more to the timescale of evolution than the underlying process of erosion), the conclusions which may be drawn are that there is little overall change anticipated to the basic geomorphology of the coastline (i.e. the underlying shape of the coast will be dictated by the hard geology and slowly eroding control features), but that within this, there will be a continued process of erosion over much of the coast, placing pressure on more local areas. The fundamental aim of the SMP is to consider how management of the coast, specifically its defence policy, may be best taken forward to reduce risk from flooding and coastal erosion against this background.

### 3.3 Sustainable policy

An SMP has to identify how the coast can be managed in a sustainable way in terms of managing and adapting to flood and coastal erosion risk in the light of future climate change and sea level rise. In addition to this, it also aims to deliver wider environmental and social benefits as part of the SMP policies.

As an overall principle it is adequate to take the definition provided by the original 1987 Brundtland Declaration of sustainable development: *“development which meets the needs of the present without compromising the ability of future generations to meet their own needs”*, subsequently amended and adopted in the Defra SMP guidance, in relation to defence management policy as avoiding: *“tying future generations into inflexible and expensive options for defence.”*

While this provided an initial intent, encapsulating the long term view being taken by the first review of the SMP, it has to be realised that such a definition lacks (quite correctly, given its context) specific guidance as to the day to day, area by area management of individual sections of the coast or of risk. It is essential, therefore, to interpret this in relation to the actual situations that exist and the future that is envisaged.

There are two aspects to sustainability:

- the effort needed to deliver an outcome – such as pressure resulting from changing the coastal form, such as resisting erosion
- the harm or benefit resulting from the outcome - the vision of what is wanted of the coast

These have to take account of the issues in a particular area, for example: natural processes, ecology, homes, businesses, navigation or recreation.

The issues along the West of Wales coast have been identified from the following sources of information:

- earlier studies, such as the first SMP, strategies and scheme studies,
- the first consultation period, stakeholder meetings and discussions with the Key Stakeholders (RMF) and Client Steering Group (CSG); and
- a review of policy documents, structure and local plans

Ideally, the most sustainable approach is not to intervene on the coast and to let it respond in a dynamic way to natural processes occurring in the Irish Sea. There is an increasing need to manage flood and erosion risk through alternative methods, such as flood warnings and improving the resilience of individual properties, in an attempt to adapt to climate change and sea level rise. This reflects the developing Welsh Assembly Government “New Approaches” policy which reflects the harsh economic reality that the Nation will not be able to provide all the defences needed in an ideal world and that some communities may need to adapt and move to be sustainable.

This also fits with the intentions of the European Water Framework Directive, which aims to restore water bodies (including coastal areas) to their natural state, unless there is a good reason not to. This can be done where there are no issues that need managing. However, the coast and hinterland are home to a wide variety of activities, features and issues often with complex interactions.

There are parts of the coast that people would not wish to change as the impact would have a detrimental effect on the sustainability of other issues or features elsewhere on the coast. These may be natural, man-made or social features that the present generation wants to pass on to future generations. It must be remembered however that climate change and, in particular, sea level rise, may have a very significant detrimental impact on such features and, if they are to survive will need to adapt.

The right balance needs to be achieved between these two extremes, whilst also making sure inflexible and expensive management plans are not passed on to future generations. Even where the coast is currently managed, future intervention may not be the right choice if it is likely that on-going management will have a detrimental effect on natural processes or impact on other parts of the coast long-term. It is likely that management in these places will increase in the future as the coast evolves or because of climate change. Careful consideration would therefore be needed to decide whether it would be sustainable to continue existing management practices rather than letting the coastline behave more naturally. The wider National context is that all coastal communities in Britain, and indeed, around the world, will be experiencing these changes at the same time placing potentially intolerable pressures on national budgets making any defences unaffordable.

### 3.3.1 Natural Processes

The geology of the Welsh coastline, over most of the frontage, provides clear evidence of how sea levels in the area have changed. Over the last 2,000 years, this change has been quite minimal (averaging less than a millimetre per year). However, we are now entering a period of anticipated accelerating sea level rise that will most likely impose greater pressure on the coast to erode and could in some areas; particularly where the shoreline is dependent on natural protection provided by beach material, result in significant change. We have to plan for this change. In general terms we have to expect greater energy against the coast and against defences coupled with a potential reduction of sediment along sections of the shoreline. If we choose to continue to defend our shorelines in the same locations that we do at present, then the size of the defences may need to increase. We need, therefore, to be looking to create width of foreshore where this is possible, either through setting back defences or through modifying the approach we take. Equally, we need to be recognising the importance of the geomorphological control that exists on the coast, working with this to sustain the shape of the coast and thus to retain and maximise the use we make of the sediments which are available.

As discussed earlier, there are areas of quite significant transfer of sediment along the shoreline. This is a coast where action in one area can have major impact elsewhere. In considering the sustainability of managing areas of the coast we have to understand the significance of these impacts such that we are able to maximise the use of sediment without creating problems elsewhere. A sustainable shoreline sediment system is one that is allowed to behave as naturally as possible, without significant further intervention.

### 3.3.2 Economic Sustainability

One of the difficulties facing us, as a nation, is the cost of continuing to protect shorelines to the extent that we do at present. Many of the defences that exist today have been the result of reactive management with often limited understanding (or

perhaps knowledge) of the long-term consequences, including financial commitment. Studies over the past few years have established that the cost of maintaining all existing defences is already likely to be significantly more than present expenditure levels. In simple terms this means that either more money needs to be invested in coastal defence, defence expenditure has to be prioritised, or funding has to come from other sources based on the benefit they bring. Whilst the first option would clearly be the preference of those living on or owning land along the coast, this has to be put into context of how the general UK taxpayer wishes to see their money used. Given that the cost to provide defences that are both effective and stable currently averages between £2million and £5million per kilometre, the number of privately owned properties that can be protected for this investment has to be weighed up against how else that money can be used, for example education, health and other social benefits.

Furthermore, because of the climate changes being predicted, which will accelerate the natural changes already taking place, these recent studies have also established that the equivalent cost of providing a defence will increase during the next century, possibly in some areas to between two and four times the present cost. Consequently those areas where the UK taxpayer is prepared to continue to fund defence may well become even more selective and the threshold at which managing an area becomes economically viable. Whilst it is not known how attitudes might change, it is not unreasonable to assume that future policy-makers will be more inclined to resist investing considerable sums in protecting property in high risk areas, such as the coast, if there are substantially cheaper options, such as constructing new properties further inland. It is extremely important that the long-term policies in the SMP recognise these future issues and reflect likely future constraints. Failure to do so within this Plan would not ensure future protection; rather it would give a false impression of a future shoreline management scenario which could not be justified and would fail to be implemented once funding was sought. The implications of these national financial constraints are that protection is most likely to be focussed upon larger conurbations and towns, where the highest level of benefit is achieved for the investment made, i.e. more properties can be protected per million pound of investment. The consequence is that more rural communities are more likely to be affected by changing financial constraints, but from a national funding perspective, i.e. best use of the taxpayer's money, this makes economic sense.

However, sustainability cannot only be judged on the effort necessary to defend areas. There has also to be consideration of what values, what heritage may be passed on to future generations. This is not just in the bricks and mortar that are being defended but is the culture, character and vitality of the coastal communities. As a result, there has to be a sensible balance achieved between those areas where the increasing pressure from the changing shoreline will make defence unacceptable in reality and those where defences can be maintained but at increased cost. The SMP has to consider this in terms of:

- What is the value that is being defended, whether this is in terms of a viable sustainable community or merely from the economic perspective of a hard asset?
- Whether defences themselves are causing a further deterioration in conditions which makes their maintenance increasingly difficult.
- How management practice will itself evolve. For example in following one course of action will this lead to further defences being needed, and further resources being put into defence.

In the latter case the SMP attempts to identify where there is a need to possibly take earlier action to support existing natural structures or to take advantage of existing foreshore width, so as to provide a more sustainable defence system in the future.

In many respects sustainability and the balance which we are attempting to achieve may be considered in terms of how the consequence of our action now will be considered in the future. Either in terms of these consequences or in deciding to defend or not defend, a simple test of sustainability is the degree of regret that might be felt in the future of the decision which is being made now. Will we wish that we had taken a different course of action?

### 3.3.3 Natural and Historic Environment

#### Nature Conservation

The forces of nature have created a variety of landforms and habitats along the Welsh coastline. There is a legal requirement to consider the implications of any 'plan' or 'project' that may impact on a Special Protection Area (SPA) or Special Area of Conservation (SAC), through the European Union Habitats Directive (Council Directive 92/43/EEC) and Birds Directive (Council Directive 79/409/EEC). The Welsh Assembly Government High Level Target for Flood and Coastal Defence (Target 11 – Biodiversity) also requires all local councils and other operating authorities to:

- Prevent damage to environmental interest
- Ensure no net loss and reduction in quality to habitats covered by Biodiversity Action Plans
- Seek opportunities for environmental restoration and enhancement

A key requirement for the SMP is therefore to promote the maintenance of biodiversity or enhancement, through identifying biodiversity opportunities. Coastal management can have a significant impact on habitats and landforms, both directly and indirectly. In places, coastal defences may be detrimental to nature conservation interests, e.g. producing coastal squeeze, but in other locations defences may protect the interest of a site, e.g. freshwater sites. Coastal habitats may also form the coastal defence, e.g. the shingle ridge along Tan y Bwlch or at Newgale. Therefore, coastal management decisions need to be made through consideration of both nature conservation and risk management. Although the conservation of ecological features in a changing environment remains key, in terms of environmental sustainability, future management of the coast needs to allow habitats and features to respond and adjust to changes such as accelerated sea level rise. It is recognised that true coastal habitats cannot always be protected in situ because a large element of their ecological interest derives from their dynamic nature and this is important to ensure the continued functionality of any habitat. Similarly in terms of many of the geological designations many of these rely on fresh exposure of the cliffs. This poses a particular challenge for nature conservation and shifts the emphasis from site 'preservation' to 'conservation'. Therefore, accommodating future change requires flexibility in the assessment of nature conservation issues, possibly looking beyond the designation boundaries to consider wider scale, or longer term, benefits. The SMP also needs to consider opportunities for enhancing biodiversity throughout the SMP area, not just at designated sites.

### Historic Environment

Man's interaction with the coast has both shaped the coast we see today, but also the behaviour of the coast; the opportunities it has provided and the constraints it has imposed, has shaped the development of existing settlements and coastal activity. An important function of the SMP is in identifying heritage assets at risk, taking account not only the designated features themselves but the context within which they are located. The aim within the SMP is to avoid damage to the historic environment and cultural heritage, recognising that historic assets tend to be a finite and non-renewable resource. However, in developing the SMP, it also has to be acknowledged the potential economic, technical and environmental constraints associated with direct protection of all sites. It is therefore appreciated that there will be a need to mitigate loss. The SMP aims to provide the assessment of risk and this information can subsequently be used to work out how to mitigate those pressures and in turn to calculate the resources needed to 'make safe' or record the unique legacy of historic places.

It is also recognised that there may be substantial costs entailed with the mitigation process and that even through this mitigation, with respect to specific features, there may be no effective mitigation for historic landscapes.

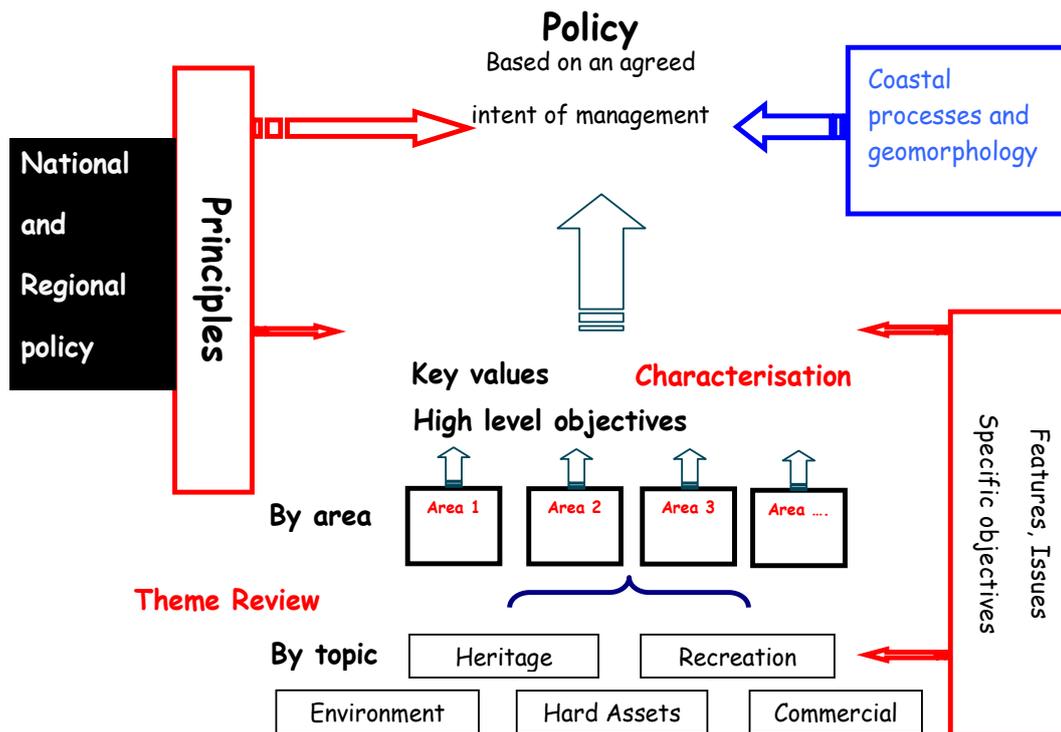
The natural and historic environment of the West of Wales coastline, quite apart from its intrinsic value, is acknowledged to be of exceptional importance in tourism and to the very way of life of people living in the area. In looking to sustain this environment, therefore, the SMP has to consider how the natural and built environment co-exist on this dynamic coastline.

## **3.4 Thematic Review**

The aim of the SMP is to provide an assessment of flood and erosion risk at the national level and, associated with this, an indication of the overall potential level of commitment to defence in these areas. Equally the SMP aims to provide a general assessment of appropriate policy for risk management at a level that will assist direct management of defences in a manner which will support other management objectives for the areas. Clearly to address both levels there needs to be a layered approach to the SMP analysis. To achieve this, despite maintaining a clear awareness of the broader levels of interactions between areas, it is necessary, to allow focus on all issues, to consider sections of the coast in detail and within which individual policy units can then be derived. In taking such an approach consideration has also to be given to the higher level issues, such that the interaction between these is not lost.

The public consultation undertaken at the start of the SMP allowed issues to be identified for individual features within the area. This was used to develop an overall characterisation of the coast (See Appendix E), which in turn assisted in developing specific objectives for management. Consideration of this overall characterisation allows the coast to be divided into sections, through which more detailed consideration could be given to the development of policy. This process is discussed in Section 3.4.

The figure below illustrates the approach and understanding of the development of policy for SMP2, incorporating all the aspects of work detailed in the previous sections.



**Figure 3.4 Schematic of SMP2 Policy Development**

### 3.5 Development of Policy

#### 3.5.1 General Structure

Section 4 of this document discussed the development of policy. The introduction to Section 4 explains how this process has been structured. The coast is broken down into general Coastal Areas to provide greater focus on individual sections of the coast. The rationale for this is explained. Within each Coastal Area there is an overall discussion of the area, explaining how the principles set out in Section 1 have been applied to the particular character of the area. This leads on to the development of policy which is subdivided into policy Development Zones.

#### 3.5.2 Derivation of Policy Development Zones

There is quite clearly no single issue which dominates the development of policy on the coast. From whichever perspective the coast is viewed, there are always overlapping issues and interests between sections. Purely from the manageability of developing policy in sufficient detail, however, the coast has to be divided. This has been done in such a manner as to minimise the residual linkages between one section of the coast and the adjacent section, but also to ensure that in developing and discussing policy, all major interactions across all themes are able to be considered. Figure 3.5 maps out in broad terms the high level division of the coast. It is within these sections or zones that individual policy units may be developed. This division is not intended to define hard barriers to thinking about the coast as a whole but solely a practical means of examining the coast in detail. So as not to be confused with the final policy units, the sections are called, merely as a matter of labelling and convenience, "Policy Development Zones"

(PDZ). Within each of these zones are identified the principal management issues which need to be addressed.



Figure 3.5 – High Level Division of the Coast

### 3.5.3 Management Areas

PDZs, as described above, are merely a convenient mechanism for ensuring that policy is developed over appropriate lengths of the coast to ensure interactions are taken into account. Policy units are then sections of the coast for which a specific defence

management policy (No active intervention, Hold the Line, Managed Realignment or Advance) are defined. However, as discussed above there may be dependencies between Policy Units (to justify a policy of retreat in one area may be on the assumption that an adjacent section of coast is held). Having defined these policies, therefore, it is equally important to group policy units where there is this dependency. Such groups of policy units are defined as “Management Areas”. It is within these management areas that the overall intent of management of the coast can best be described.

The definition of the management area is only at the end of the policy development process. A statement can then be produced providing the understanding of why a specific area of the coast is to be managed in this way and how individual policies work to deliver that intent.

#### 3.5.4 Identification of Policy Units

Within each PDZ different scenarios are considered; always starting with the policy for “No Active Intervention” (NAI) for all locations within the PDZ. This provides the baseline for considering the need or the sense in actively managing the coast. The second scenario is based on the policy developed from SMP1, taking into account further detail or modification which may have been developed during strategy studies undertaken since SMP1. These are termed “Present Management” (i.e. that policy which the SMP2 is reviewing<sup>1</sup>) and provides the starting point for considering future management. This Present Management scenario sets out a series of policies for individual lengths of coast within each PDZ. Within any PDZ these individual policies may be different for specific lengths along the shoreline, such that one length may be to “hold the line” (HTL), in a different length the policy may be for managed realignment (MR) or advancing (A) the line of defence, or may be to take no active intervention. Furthermore, over different time periods, the policies may change from retreat (R) to holding the realigned defence line (HR).

The two initial scenarios are compared and the way in which they allow the coast to develop and the manner in which they meet or fail to meet objectives defined within the SMP2 is considered. For some sections of coast the scenarios may in effect be the same. In other areas one scenario may address certain issues but fail to address others. In this comparison, therefore, there may be the opportunity to introduce adaptation which will move forward to a more sensible approach to long term management. In such cases new scenarios are then considered, looking how best to deliver the objectives of the SMP.

From this approach either the “Present Management” policies are confirmed or new policies developed for individual sections of the shore. A preferred defence policy is then defined for a specific section of the coast. This section of coast is the policy unit. This defines how that section of coast should be managed over the life time of the SMP.

There is appreciation that there may be a need for transition from present management through to the long term policy. This may be a result of a new policy being recommended or it may be in recognition of the way in which the coast is likely to evolve. To allow adaptation there is scope within the SMP for changes in policy over

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<sup>1</sup> It is recognised that the purpose of the SMP2 is to review this present management, making recommendations where necessary for these policies to be updated. As such the SMP2, on completion and approval, will define present management for the future.

time. Policy for each unit is therefore defined over time periods; from now to 2025 (short term), from 2025 to 2055 (medium term) and from 2055 to 2105 (long term). However these are indicative timescales and the driver for policy change will be climatic changes such as sea level rise resulting in intolerable flooding frequency and not any rigid date.

The aim of developing policy for individual units of the coast within the framework of the PDZ is to ensure the broader implications of managing one policy unit with respect to another unit is considered; hence the scenario approach. These implications are discussed in the process of developing policy within Section 4. Inevitably, therefore, there are dependencies between policy units, the intent being to manage groups of policy units to best deliver objectives for management of areas of the coast. This is discussed below.

### 3.6 Policy Development Zone Analysis

The analysis and discussion for each zone aims to provide an understanding of the issues and nature of the area in such a manner which is logical and rigorous but also in a manner that may referred to and understood by both coastal managers and people who use or live on the coast. This analysis is undertaken in Section 4 and for each zone a standard approach, in line with the SMP guidance, has been taken. This has been set out in three sections:

- Description,
- Physical Characteristics and
- Management.

These are explained below.

#### **DESCRIPTION**

This section merely describes where things are and what they are, in terms of: the underlying physical nature of the coast, the existing defences and, where appropriate; their overall condition, together with the use being made of specific areas. This section aims to set the scene, starting to pull together the overall picture. More detail on the physical processes is provided in Appendix C. In association with the physical description, this draws on the thematic review (SEA scoping report) (Appendix E) and the consultation (Appendix B) in identifying the different issues and interests associated with the specific zone. Again the aim of this is to provide an overall appreciation of the way in which elements of how the coast is valued come together.

#### **PHYSICAL CHARACTERISTICS**

##### *Basic Parameters*

These provide direct information on wave climate and water level within each zone, together with a synopsis of rates of erosion for different sections of the coast within the zone. A brief description of how the coast is behaving is provided, aiming to explain exposure conditions and where the coast is attempting to change. From this may be understood where there may be pressure developing in relation to the use of the coast and an initial appreciation of what may or may not be sustainable in the long term.

##### *Unconstrained Evolution*

Although recognised to be a totally theoretical scenario where there has been or there is still major modification of the coast, this section briefly examines what would happen if all man's influence were suddenly removed. The aim of this is to provide a better

understanding of how we are influencing the coastal behaviour and therefore the stresses and broader scale impact that are introduced. This assists in assessing first how the coast might wish to change but also in defining the limits of interaction which the SMP should be considering.

## **MANAGEMENT**

### *Current Management*

Current management is summarised in terms of the policies developed during SMP1 and any subsequent strategic studies or schemes.

### *Scenarios*

The section provides a more detailed description and assessment of the two base line scenarios for the whole zone. This starts with the “No Active Intervention” Scenario and then considers the current management scenario (“With Present Management”). In many cases SMP1 strategies have only looked over a period of 50 years. The SMP2 extends the implication and intent of the current management policy over the full 100 years and comments, where appropriate, on the further implications of this beyond this period of time. The aim of the “No Active Intervention”, is to identify what is at risk if defences were not maintained. In a similar way “With Present Management” aims to examine how the coast may develop, identifying where there are benefits in this management approach and where there may be issues arising in the future. Associated with each scenario is a brief summary of the key risks based on the MDSF and strategy findings. This provides a headline assessment of how each scenario achieves the key objectives set out in section one above.

### *Discussion and Detailed Development of Policies*

This sub-section uses the two baseline scenarios to consider specific issues in more detail, looking at both the long term implications of the current policies and stepping back from the more local strategy development areas to consider any impacts on the coast as a whole. The discussion also considers any detailed proposals put forward in strategies and comments on these from the broader perspective. Where the current policy is felt not fully to address some of the issues being identified, further scenarios are developed. Typically this has been found to be a variation within one of the baseline scenarios, rather than a scenario with such wide reaching impacts that the influence of management affects area outside the development zone being considered. From this discussion and from the analysis of different approaches and their consequences, recommendations are made for the SMP policy. This principally starts with where management would take the coast in the long term, working back to how policy should therefore be adapted over the short and medium term periods.

### *Management Areas*

Policy units are grouped as management units, providing coherent intent as to the management and dependencies over the area.

## **3.7 Management Area Policy Statements**

The policy units and management areas are developed in the analysis described above. A summary or statement is presented for each management area.