



# **West of Wales Shoreline Management Plan 2**

Cardigan Bay and Ynys Enlli to the Great Orme Coastal Group

Overview of Plan

## Section 5 Summary and Implications of Preferred Plan

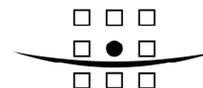
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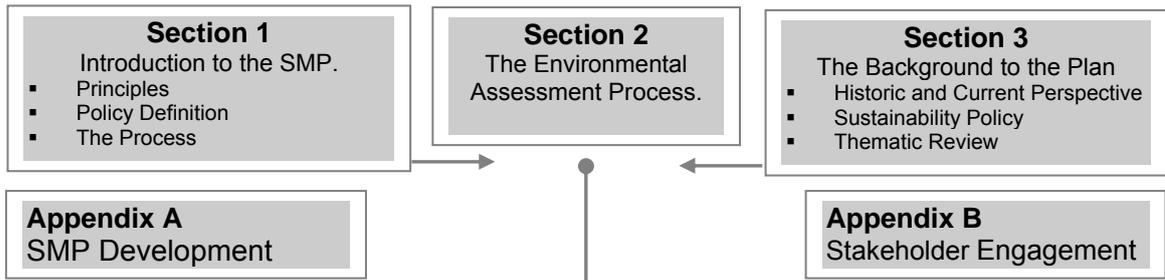
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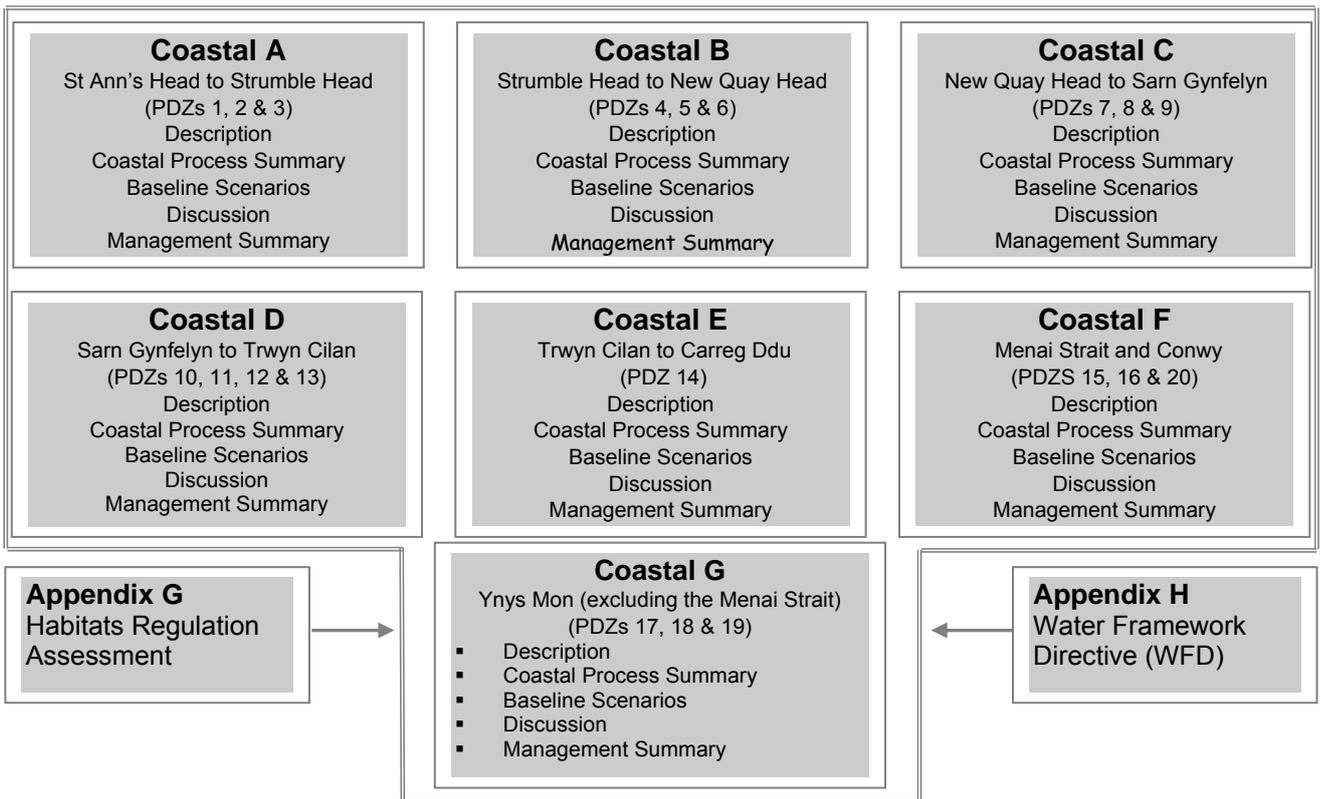
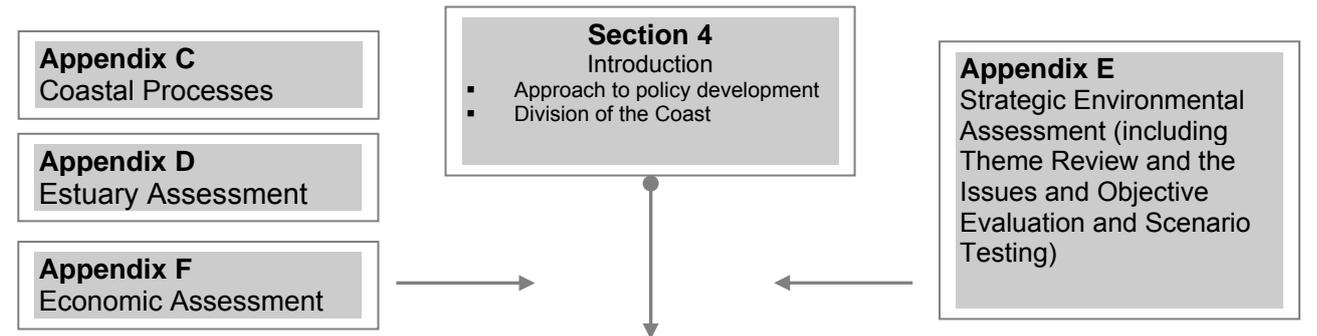
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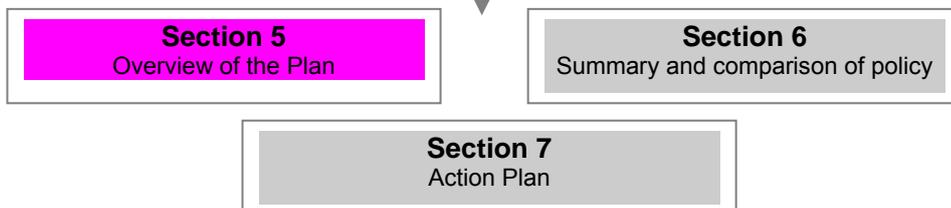
**INTRODUCTION AND PROCESS**



**PLAN AND POLICY DEVELOPMENT**



**OVERVIEW**





## 5 INTRODUCTION



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## 5 SUMMARY AND IMPLICATIONS OF PREFERRED PLAN

### 5.1 Plan for Balanced Sustainability

The SMP delivers a plan for the management of risk from tidal flooding and erosion, setting policy solely for coastal erosion and flood risk management. However, the way in which these risks are managed obviously has a significant impact on all aspects of the coast in terms of its human and social function, the natural environment and the heritage value.

The right balance needs to be achieved between the need to intervene in the natural processes whilst making sure inflexible and unaffordable management is 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 impact on other parts of the coastal system. It is likely that costs will increase in the future as the coast changes, either as it is now doing or because of climate change. Careful consideration has been given to the balance between whether it would be sustainable to continue existing management practices rather than letting the coastline behave more naturally. The wider context is that all coastal communities in Britain, and indeed, around the world, will be experiencing these changes simultaneously placing greater pressures on national budgets making many defences potentially unaffordable.

This does not mean that we should walk away from management at the shoreline. Indeed, in the West of Wales area the coastal zone is essential for the future prosperity of the area. The majority of the major towns are at the coast and there are numerous small villages along the coastal fringe, whose character and cultural heritage are inextricably linked to their association with the sea. These towns and villages are an essential part of the character of West of Wales as well as being important residential areas and providing vital services to the largely rural hinterland. The various harbours add both immediate value to these settlements and, in the case of the major ports, are identified as important commercial and transport hubs for Wales. Other harbours are important sailing centres, forming a necklace of harbours around the coast, supporting investment in the area. Many of these harbours also provide important services to the local fishing effort as well as supporting more generally the watersports industry.

There are important transport routes which run within the coastal area; several of the main roads or local roads linking communities run close to or at the shoreline or run through areas at risk from coastal flooding. The main railway lines along the north coast and along the coast of north Cardigan Bay run at the shoreline over much of their length, with critical locations at risk.

The outstanding natural beauty of the coast is important in terms of landscape, its ecological value and in understanding of the geological and geomorphological changes that have occurred. This, together with the historic landscape, has an intrinsic value but also underpins the attraction of the coast for tourism and as a place to live and work. The beaches provide a significant value in this respect.

All these aspects have to be balanced alongside the increasing risk from erosion and flooding and assessed in terms of the management approach and effort that is required to sustain these features now and in the future.

Increased pressure on the coast may lead to loss of beaches unless we adapt, maintaining defences in the present form is likely to be more expensive and may actually result in negative impacts on the very values that we are trying to sustain. There are difficult issues that have to be addressed now, in order to establish the future sustainable management of the coast.

#### Overview of the Risk and Management Issues.

The West of Wales SMP area considers the coast from St Ann's Head in Pembrokeshire, in the south, to The Great Orme in Llandudno, in the north. It covers an area containing both hard and softer eroding cliffs and lower lying areas extending inland, which are at potential risk from coastal flooding. Eleven major estuaries, the Nyfer, the Teifi, the Dyfi, the Dysynni, the Mawddach, the Artro, the Glaslyn/Dwyrhyd, the Cefni, the Alaw, Traeth Dulas, the Conwy as well as the Menai Straits cut the coast and there are several smaller estuaries or areas of low lying land, which are closed off by the shingle ridges and beaches. Flood risk to the low lying coastal areas and the estuaries poses a potential threat to local communities, especially with sea level rise. Assessing the sustainability of these communities is important in the development of policies as is the potential impact on the agricultural use of the low lying plains within the estuaries.

#### *The rocky shoreline.*

Over long lengths of the coast, the shoreline comprises relatively hard sections of rock cliffs or areas that are strongly controlled by rock outcrops and headlands. This is most obvious in areas of Pembrokeshire and southern Ceredigion, around the western tip and northern shoreline of the Llŷn Peninsula and around Holy Island and the north of Anglesey. All these areas are where the rocky shoreline has been subjected to scour by the movement of ice sheets in the past and where the battering by the sea has tested the resilience of the shoreline over millennia. Typically in these areas, with the high rocky cliffs, the limited access to the shoreline and generally lower grade agricultural land use at the cliff top, the slow erosion rates, is not seen as a significant problem or is seen as an accepted aspect and risk associated with living within a coastal environment.

Particularly along the Pembrokeshire coast several of the headlands are sites of historical value where prehistoric forts and settlements were constructed. Their natural coastal headland setting is seen as being part of the historic landscape within which these features reside. Within these areas, present day settlements have tended to develop within the bays that are a feature of this type of coastline. They have, by the nature of their location, close association with the sea, and in many cases, due to the steeply rising land around, tend to have developed right up to the shoreline. Where there has been more recent growth associated with the community, this has tended to have grown around the traditional, core community at the coast. As such the core community centre is often seen as the focus for the growing community. Access to the shore and the presence of beaches within these bays are often an important aspect of the community value, often supporting the tourism that itself supports the vibrancy of the community. With sea level rise and, indeed in some areas, merely the continuing pressure of present erosion, existing defences may result in squeeze of the beach area; higher, larger defences will separate the community from the sea.

Particularly due to sea level rise, the loss of beaches, increasing flood risk and risk from increased wave action presents a problem as to how communities may still be sustained, without destroying their important character. The SMP has considered these issues and where possible highlights the need for changes in approach to defence.

This can mean that changes have to be made along the sea front and to the way in which the sea front is used. Such change both in terms of defence and in terms of change within the community is recognised to need time. Change needs to be planned, such that communities and individuals can adapt. In highlighting this now, the SMP provides the time within which adaptation can be planned. In a few locations, however, local adaption may not be a practical answer and, under more extreme predictions of sea level rise, communities would be lost. How this is managed goes wider than purely shoreline management and poses questions that have to be resolved at a regional or national level.

#### *Erodable Frontages.*

Other areas of the open coast comprise softer material, either as weaker rock strata or where the coast is overlain by clays or other glacial deposits. In some of these areas; such as within St Brides Bay, the New Quay Bay area, the shoreline to the south of Aberystwyth, areas of the south and north shorelines of the Llyn; particularly within Porth Neigwl and along the Nefyn frontages, and lengths of the western side of Anglesey, these frontages can be prone to major movement and instability of the high coastal slope. This can in part be exacerbated by erosion at the toe of the slope, but can equally be result of poor drainage and underlying instability of the ground.

In other areas the soft exposed shoreline is relatively low, forming a low erodable cliff face to an area of relatively flat land between the sea and the typically rising hills and mountains behind. These areas tend to be more intensely developed, particularly within the low lying plateaus or less steeply rising coastal slopes. Such areas as Broadhaven, Newport, Cardigan, Aberaeron to Aberystwyth, Towyn, Barmouth, Criccieth through to Pen y Chain, Aberdaron, Caernarfon, along the south and south east coast of Anglesey; in areas such as Beaumaris and Rhosneigr, along the Conwy shoreline of Llanfairfechan and Penmaenmawr and within the Conwy estuary at Conwy and Deganwy, exemplify the significance of development along this lower lying coastal strip.

Many of these areas are subject to on-going erosion, and in many areas there is also the associated risk of coastal flooding. Without defences the coast would continue to retreat, particularly within those areas with softer geology. This might only be a retreat of tens of metres, but erosion or cliff slippage could occur over several hundreds of metres over the next hundred years, especially to areas of unstable coastal slopes.

The risk of erosion threatens property and assets in all the major settlements and several of the smaller villages. It also threatens important historical features and puts pressure on many of the coastal flood defences. This typically softer coastline supports the main economic centres. This shoreline area is, therefore essential for the local and regional economy, which also relies heavily on shoreline-related tourism and agriculture.

However, erosion often creates exposures which are important to the understanding of the geology of the region, valuable for both education and for academic study. In reality, studies, such as this SMP, would not be possible without the understanding provided by study of these areas. It would not be possible to plan for the future without an understanding of the past. Erosion in one area also provides sediment that maintains the beaches, provides defence to other areas of the coast, as well as sustaining many of the important nature conservation habitats. The soft unstable coastal slopes also provide areas of ecological value in their own right.

In many of the lower lying areas, development of towns and villages are at present only marginally above a level at which regular flooding occurs. With sea level rise, the SMP has highlighted that this risk increases significantly. Areas at present subject to flooding on more extreme conditions may be at risk of regular inundation in the future. It may be technically feasible to continue to manage this risk over the next 100 years with the level of sea level rise at present anticipated. However, should sea level rise be greater or looking beyond the 100 year period there would be significantly greater risk that has to be considered. In looking at this, the SMP considers not just the present Defra guidance on sea level, but also the possible 2m sea level rise scenario. Although considered unlikely over the next 100 years, this alternative scenario allows us to identify where risk may occur in the even longer term. The SMP recognises that we should not be over-reacting to such a threat. However, it does highlight that such risk needs to be taken into account when planning future development that is likely to provide the basis for future growth. The SMP highlights such risk to towns such as Aberaeron, Aberystwyth, Harlech, Porthmadog, Caernarfon, Bangor, Beaumaris and within the mouth of the Conwy; all areas where core development, essential for the economic vitality of the town could be at significant risk in the long term.

#### *Coastal Sediment Features.*

Among the most sensitive areas for nature conservation at the coast are the areas, typically around the estuaries, where the shoreline comprises mobile sediment. The shingle ridges and dune systems are a vital part of the coastal ecosystem, as well as being an important recreational and tourism resource, and, in areas, providing flood defence. These mobile systems require width to function both naturally and as a frontline defence or buffer against erosion. They rely upon adequate sediment supply to sustain their natural shape. Several of the larger systems are directly associated with the formation and behaviour of the estuaries, areas such as the dunes and shingle ridges at the mouth of the Teifi and Dyfi, Morfa Dinlle and Morfa Harlech are good examples of this, although there are many smaller systems associated with other estuaries. Other mobile sediment systems have developed closing off valleys and areas of low lying land. Typical of such barrier shorelines occur at Newgale, Goodwick, Tan y Bwlch, Criccieth, Pwllheli, Abersoch and Cemlyn Bay, while in areas such as Borth and Fairbourne there are shingle barrier systems linking through to dunes spits at the mouth of the estuaries.

There are also sediment systems that have tended to accrete over or into areas of low lying land or have accreted against harder headlands. Examples of this are at Newport Sands, Morfa Dyffryn, Morfa Bychan, to the west of Pen y Chain and Mynydd Tir-y-

Cwmwd, Valley and the estuary in fill systems of the Cefni and Aber Ffraw on Anglesey and at Llandudno.

All these soft sediment systems are sensitive to sea level rise. In some areas, the coastal features are relatively stable, particularly where there is good sediment supply; such as the large dune systems of Morfa Harlech and Morfa Bychan. Although even in these areas of greater stability, there is variation due to the influence of changes within the estuaries or due to variation in wave climate. Other areas are more vulnerable to present change, such as the dunes at Aberdyfi and Poppit, on the Teifi Estuary, or at the mouth of Artro, where variation in the behaviour of the estuaries, the estuary channels and the associated nearshore ebb bank systems result in periods of dune growth and dune erosion.

In many cases, however, particularly with respect to some of the barrier systems, the backshore shingle ridges have become increasingly fragile. At Newgale; the shingle ridge is frequently overtopped. At Tan Y Bwlch, Borth and Fairbourne and along the Criccieth and Pwllheli frontages there is continued erosion of the narrow shoreline ridge. At Morfa Dinlle and Morfa Conwy and at West Shore Llandudno, the dune barriers are under pressure from erosion.

With sea level rise, all these systems will attempt, generally, to roll back; to adjust to the new conditions and the increased wave energy. Where defences are in place, such as at Goodwick, Newport Parrog, Pen y Eryd, Borth and Fairbourne, to both east and west of Pwllheli, even at major towns such as to the south of Aberaeron, Aberystwyth and Llandudno, defences will come under increasing pressure as sea level rises. As the natural barriers upon which the defences are formed attempt to roll back, and as there is further loss of foreshore, the defences will be under attack. In these areas and in areas of natural dune and shingle defence systems, in particular, creating or maintaining width, within which the underlying natural defences can function, is essential both to maintain their natural condition but also to allow them to provide a flood defence function.

#### *The Estuaries.*

In general, estuaries are the most dynamic systems of the coast. They have adapted naturally to change in tidal flows and the variation in river flows. Where man has intervened, this can have long term and wide ranging impact on the way in which the estuaries behave. The Teifi has responded to both natural change and man's intervention with significant change at the estuary mouth. A large area of former flood plain within the Dyfi estuary is at present excluded by the defences and railway line. This has influenced the way in which the channels in the estuary move and has influenced that behaviour of the estuary mouth and the development of the shoreline to either side. Similarly, on the Artro estuary and the larger Glaslyn and Dwyryd estuary system, changes have been made by man over the last century. The estuary systems and the adjacent open coast are still responding to these changes. This has led, in the case of the Artro to a situation where the coastal area is now vulnerable to erosion. In the case of the Glaslyn and Dwyryd, the construction of the Cob has resulted in increased sediment accretion.

In each case the SMP has had to consider how management within the estuary may impact over a far broader area. Restoring the natural, or more natural, behaviour of the estuary can have benefits to the management of the open coast. Defences within the estuaries will be more difficult to manage with sea level rise. Raising defences will make use of the defended land more vulnerable to catastrophic flooding should defences fail or should the design standards be exceeded. The SMP, as well as looking at the broader impacts, has had to consider this increased vulnerability at specific locations. In many cases the SMP identifies the need to consider change in use of the estuaries, to allow time for adaptation and to ensure that present use is built on a more sustainable footing, as well as providing scope for natural habitat creation. In some areas, it is recognised that there may be significant constraints, such as the important railway and road links. This needs to be considered at a national level, rather than on a defence by defence basis. The SMP also recognises and highlights the need for a more integrated approach to management, considering water level management within the estuaries, the impacts on agriculture, the individual properties and villages at risk and well as the use of the low lying land for recreation, golf courses, boat use and the fishing industry; all alongside the nature conservation interests and potential benefits change could bring. Recognising this complexity, while the SMP has set broad level policy for defence, recommendations have been made for more detailed planning of how policy might be delivered. The intent of the SMP in some of these areas has been to highlight the key issues in terms of flood management and to provide an improved understanding of estuary behaviour, providing a framework for developing broader level management plans.

Such plans are already under consideration for the Teifi and to a degree for the Dyfi. Here the SMP aims to contribute and steer the thinking of these plans, rather than impose a management approach. In other estuaries such as the Dysynni, the Arthro, Dwyrdd, Foryd Bay and Conwy, the SMP sets a clear intent of management but also recommends that this is taken forward through more detailed plans developed in consultation with landowners and organisations with an interest in the estuaries.

Appendix C provides the background understanding of the processes at work along the various frontages and this understanding is used and discussed further within the main SMP document in considering the main implications under the two baseline scenarios of No Active Intervention (NAI) and With Present Management (WPM). These two scenarios in effect ask the questions:

If we stopped managing flood and coastal erosion risk management now, what would happen?

If we continue to manage the coast in the way in which we are managing it now, what are the risks, how will the coast respond?

These scenarios form the basis for developing the SMP.

## 5.2 What is at risk, what are we managing?

Under the No Active Intervention scenario, there would quite clearly be major change in the future use of the shoreline. The overall risk to communities is set out in the following Box 1.

### **No Active Intervention Box 1. Communities - potential economic damage to property:**

Without defence there would be significant loss to all the major towns on the coast. Overall it has been assessed that:

Some 1600 properties would be lost due to erosion, with a discounted present value in the order of £30million (£200 million current value). This does not take account of services and loss of amenity. The main areas at risk from erosion are:

- |   |  |
|---|--|
| - Little Haven and Broadhaven (50 properties) | - Aberporth and the villages of South Ceredigion (20 properties) |
| - Fishguard and Newport (20 properties)       |  |
| - New Quay and Aberaeron (130 properties)     | - Aberystwyth (180 properties)                                   |
| - Borth (320 properties)                      | - Aberdyfi and Tywyn (95 properties)                             |
| - Barmouth (40 properties)                    | - Porthmadog area (110 properties)                               |
| - Criccieth (100 properties)                  | - Pwllheli and Abersoch (12 properties)                          |
| - Aberdaron (30 properties)                   | - North Llyn (45 properties)                                     |
| - Western Menai Strait (110 properties)       | - Eastern Menai Strait (85 properties)                           |
| - Western Anglesey (40 properties)            | - North and East Anglesey (61 properties)                        |
| - Conwy and Llandudno (100 properties)        |  |

There are at present some 14,000 properties at risk from flooding within the SMP area. Despite the economic value of damages being discounted back to a present value, the economic losses would increase over the three time periods of the SMP (over the next 20 years, between years 20 and 50 and between year 50 and 100). This reflects both the gradual failure of defences and the impact of sea level rise making flooding more frequent. Over the 100 years, the economic loss would be in the order of £1,350 million. Over the short term, medium term and long term, the economic damages, purely in terms of direct flood damage to properties and businesses, would be of the order of £220 million, £330 million and £800 million, respectively. This does not take account of potential risk due to inland flooding and the risk from wave overtopping. The most severely affected populations centres, due to direct tidal flooding, would be:

- |  |   |
|--|---|
| - Newgale and Solva (40 properties)              | Lower town Fishguard and Newport Parrog (50 properties) |
| - Cardigan (100 properties)                      |   |
| - Aberaeron (350 properties)                     | - Aberystwyth (950 properties)                          |
| - Borth and the Dyfi Estuary (500 properties)    | - Aberdyfi to the Dysynni (350 properties)              |
| - Fairbourne (400 properties)                    | - Barmouth (250 properties)                             |
| - Harlech Area (450 properties)                  | - Porthmadog (1650 properties)                          |
| - Pwllheli (1200 properties)                     | - The Western Menai Strait (176 properties)             |
| - The Cefni and Malltraeth area (140 properties) | - Rhosneigr and Valley (250 properties)                 |
| - Holy Island (350 properties)                   | - Traeth Coch area (35 properties)                      |
| - Beaumaris and Porthaethwy (270 properties)     | - Bangor (330 properties)                               |
| - Llanfairfechan (78 properties)                 | - Conwy and the inner Conwy Estuary (1000 properties)   |
| - Llandudno (4800 properties)                    |   |

In addition, there are important transport routes located within the coast zone. Under a No Active Intervention scenario, there would be significant disruption to this network. This would include loss of access to the two national transport hubs at Fishguard and Holyhead. There is other critical infrastructure within the area covered by the SMP at a more local level, this includes several important ports and harbours, all at risk due to continuing sea level rise. The main features at risk are identified in Box 2.

### No Active Intervention

#### Box 2 Transport and Critical Infrastructure:

Without defence or managed adaption there would be significant loss and disruption to transport routes. The main areas at risks are identified below.

- the coastal road around St Brides Bay and St David's (including Little Haven, Broad Haven Newgale and Solva).
- the coastal road and access to Fishguard Harbour and through Lower Town.
- road access to New Quay and between Aberaeron and Aberystwyth.
- the road and rail network within the Dyfi Estuary, including the rail link to Aberystwyth.
- the railway line between Dyfi Junction and Pwllheli: at the Dyfi, across the Dysynni, at Friog and across the Mawddach Estuary, at Harlech, and across both the Dwyrdd and Glaslyn Estuaries, along the Criccieth frontage and at Abererch.
- the airfield at Morfa Dinlle.
- the coastal roads at Menai Straits.
- the road system to and through Beaumaris.
- the road and rail links along the north Wales coast and across Anglesey to Holyhead.
- the road and rail links along the Conwy valley and through to Llandudno.

There are some 34 harbours, landing stages or mooring areas identified within the area, providing over 2500 moorings. By their nature such facilities are inevitably at risk from flooding or potentially impacted by erosion and coastal change. The main harbours are identified below:

- |                                       |                              |             |
|---------------------------------------|------------------------------|-------------|
| - Solva, Porthclais and Porthgain     | - Fishguard                  | - Newport   |
| - Teifi and Cardigan                  | - New Quay                   | - Aberaeron |
| - Aberystwyth                         | - Aberdyfi                   | - Barmouth  |
| - Shell Island                        | - Porthmadog                 | - Pwllheli  |
| - Morfa Nefyn                         | - Caernarfon and Y Felinheli | - Holyhead  |
| - Bangor and the Eastern Menai Strait |                              | - Amlwch    |
| - Conwy                               | - Deganwy                    |             |

There are approximately 64 waste water and sewage treatment works within the SMP2 study area.

Power distribution and electricity sub stations tend to be clustered around the main urban coastal centres.

There are 27 waste treatment and recycling sites occurring within the coastal SMP2.

There are four World Heritage sites within the area at Harlech, Caernarfon, Beaumaris and Conwy, each potentially at risk. Virtually every mile of the coast of Wales bears the traces of Welsh history from prehistoric burials and forts to the coastal defences of the Napoleonic Wars and World War II, with over 300 Scheduled Monuments, some 4,000 listed buildings within the SMP coastal zone and 15 Parks and Gardens of Special

Historic Interest. Many of these features are associated with the various communities, with a substantial number of key historic sites at direct risk from erosion.

Some 400km of the shoreline is covered by a Heritage Coast designation, with large areas of the Pembrokeshire Coast falling within the jurisdiction of the Pembrokeshire National Park and much of the northwest coast being within the Snowdonia National Park. There are two areas designated as Areas of Outstanding Natural Beauty covering the much of Llŷn Peninsula and virtually all the coast of Anglesey. While these designations aim to maintain the unspoilt nature of the coastline, there is significant value associated with the various communities adding to the historic landscape and contributing to the continued vitality of these areas. This is reflected in the local designation of 28 conservation areas.

The other essential feature of the SMP area is its biodiversity and natural environment. Approximately 70% of the Welsh coast and estuaries are designated as Special Areas of Conservation (SAC) some 31 sites occurring within the SMP area. There are a further 15 Special Protection Areas (SPA) and 3 Ramsar sites. These international sites are based upon or sit beside some 160 Special Sites of Scientific Interest, which form the cornerstones of wildlife and habitat protection in Wales.

Reflecting the significance of the geology of the area there are over 120 Geological Conservation Review sites (GCR).

These various sites for nature conservation and geological value rely on maintaining natural processes, although in some areas sites may be affected by increased coastal flood risk and erosion.

All these various features are identified and discussed in Appendix E. While the No Active Intervention scenario would in general support the important natural features of the area, this would be quite evidently at the expense of the important historic landscape and the essential economic and social values of the area.

The No Active Intervention scenario highlights where these losses would occur but also sets the baseline for assessing where management of the risk to the historic landscape and economic and social features could impact on the natural shoreline.

### 5.3 Finding the right balance, the draft SMP

#### *The Proposed Plan*

In many areas, present management (the second baseline scenario) does deliver a sensible balanced approach to flood and erosion risk, certainly in the short term. However, in the future, with increased pressure on the coastline there are areas where difficult decisions will have to be made. In some areas, issues had already been identified in SMP1 and through on-going management since SMP1. SMP2 looks further ahead, over the next 100 years. One of the major benefits of this the broader view is in considering how change can be introduced and planned, such that the values associated with the coast may be maintained in a more sustainable manner, achieving a balance over time and adapting the way in which we use and defend areas.

Risk management will continue to all the main towns, although even in these areas the SMP has identified significant risk in the longer term that has to be recognised in long term planning. There will need to be some adaptation to the way in which defences are managed and the way in which areas are used. More locally and in some cases in the medium term the plan identifies the need for more significant change, with the intent that within some communities there would be loss of property. This would be necessary to ensure that defence to the rest of the community can be managed more effectively. In the case of other communities or assets on the coast, such as some of the golf courses and Holiday Parks, to continue to defend would in reality result in communities and assets being placed at increased and unacceptable risk as sea level rises and as the coast continues to change. Continued defence in the position and in the way in which they are at present may also start to impact on the behaviour of the shoreline, threatening the important natural features or impacting on the important quality of beaches and reducing the overall important tourism potential.

Even so the plan provides substantial benefits in terms of risk management. There will always continue to be a flood risk to property within the flood plain, even where it is sensible to raise defences in line with increasing water levels. The plan aims to minimise the risk but cannot exclude that risk entirely. The following Box 3 highlights the benefits of the plan in comparison with the No Active Intervention Scenario, but also highlights the continued residual risk even with the plan.

## Preferred Plan

### Box 3. Communities -:

The plan aims to reduce risk from erosion and flooding:

Of the 1600 properties at risk due to erosion under the No Active Intervention (NAI) over 1000 properties would be protected under the policies set out in the plan. Many of the properties still at risk would gain some protection over a longer period of time. The economic loss under the plan would be reduced from approximately £30 million to £8 million. The main areas where potential loss is anticipated over the next 100 years are set out below. NAI losses are shown in *italics* for comparison.

- Little Haven and Broadhaven (11 properties, 50)
- Fishguard and Newport (1 property, 20)
- New Quay and Aberaeron (43 properties, 130)
- Borth (290 properties, 320)
- Barmouth (10 properties, 40)
- Criccieth (2 properties, 100)
- Aberdaron (5 properties, 30)
- Western Menai Strait (11 properties, 110)
- Western Anglesey (15 properties, 40)
- Conwy and Llandudno (20 properties, 100)
- Aberporth and the villages of South Ceredigion (4 properties, 20)
- Aberystwyth (6 properties, 180)
- Aberdyfi and Tywyn (0 properties, 95)
- Porthmadog area (4 properties, 110)
- Pwllheli and Abersoch (6 properties, 12)
- North Llyn (32 properties, 45)
- Eastern Menai Strait (21 properties, 85)
- North and East Anglesey (30 properties, 61)

*Note: Losses are estimated based on projected erosion over the next 100 years.*

There are at present some 14,000 properties at risk from flooding within the SMP area. These properties would continue to be at risk; however the SMP would aim to reduce the impact of flooding. The economic damages would be reduced from £1,350 million under a NAI scenario to £223 million over the period considered under the plan. The risk to property would still increase over the three epochs. Over the short, medium and long term, the economic damages, purely in terms of direct flood damage to properties and businesses, would be of the order of £40 million, (£220 million NAI), £50 million (£330 million NAI) and £140 million (£800 million NAI), respectively. This reflects the increased risk associated with sea level rise, but also the intent within the plan to defend areas where it is sensible to do so without leaving people in a more vulnerable position. The most significant areas where properties may be lost due to increased risk or where there is greatest need for adaption are shown below.

- Newgale (epoch 1) and Solva (epoch 3)
- Borth and the Dyfi Estuary (epoch 3)
- Clarach (epoch 1)
- Artro Estuary (epoch 2)
- Pwllheli (epoch 2)
- Dinas Dinlle and Morfa Dinlle (from epoch 2)
- Beaumaris and Porthaethwy (epoch 3)
- Llanfairfechan (epoch 3)
- Lower Town Fishguard and Newport Parrog (both in epoch 3)
- Fairbourne (epoch 2)
- Dysynni Estuary (epoch 2)
- Porth Dinllaen and Morfa Nefyn (epoch 2)
- Porth Llechog, Moelfre and Traeth Coch (epoch 3)
- Bangor (epoch 3)
- Conwy valley (epoch 2)

There would continue to be significant flood risk to:

- Cardigan
- Aberdyfi
- Caernarfon and Y Felinheli
- Conwy and the inner Conwy Estuary
- Aberaeron
- Harlech and Talsarnau
- Valley and areas of Holy island
- Aberystwyth
- Porthmadog
- Llandudno

Where there is continued risk and the need for adaptation or change, this is highlighted within the Section 4 of the SMP document, with the specific need for change discussed and highlighted within the Management Area Statements. With the need for adaptation in the way in which defences are managed, there would be impact on the agricultural use of land in all the major estuaries. While land would not necessarily be lost, there would be a change in the nature of the land due to tidal flooding and increased fluvial flood risk. In these areas it is essential that the way in which change is managed is developed in discussion with landowners to assess how the impact on businesses can be mitigated, recognising the pressure on defences particularly with sea level rise and the need to adapt if businesses and communities are to be sustained.

In terms of many of the Holiday Parks and golf courses, some degree of change will also be inevitable. The Plan acknowledges the importance of these features and assets in sustaining local communities and in providing an important tourism attraction. The plan discusses this need for adaptation and attempts to set a framework for future management which will allow businesses to be sustained.

The plan recognises the important transport routes throughout the area. However, the SMP also highlights where, typically over the medium to long term, with sea level rise, continued defence of some of these strategic routes is unlikely to be sustainable, without substantial investment or without significant damage occurring to the adjacent shoreline. In many cases, the SMP highlights that rather than continued investment in defence, consideration must be given to realigning the road or railway, if the service provided by this infrastructure is to be sustained into the future.

The SMP recognises and highlights also that such decisions may need to be made at a national level, rather than at the local level. This recognises that, to sustain a route, action may need to be taken at a whole range of locations rather than making decisions at specific sites along the route.

## Preferred Plan

### Box 4 Transport:

The key areas where decisions need to be taken with respect to the future of the transport net work are highlighted below.

<ul style="list-style-type: none"> <li>- the coastal road around St Brides Bay and St David's.</li> </ul>	<p>There are several areas where defence of the road would no longer be sensible or would constrain appropriate management of the adjacent shoreline. The whole transport net work within the area will need to be reviewed over epochs 1 and 2</p>
<ul style="list-style-type: none"> <li>- the coastal road and access to Fishguard Harbour and through Lower Town.</li> </ul>	<p>Consideration need to be given to realignment of the road.</p>
<ul style="list-style-type: none"> <li>- the road and rail network within the Dyfi Estuary, including the rail link to Aberystwyth.</li> </ul>	<p>The potential for realigning the railway and road needs to be considered during epoch 1, in preparation for increased pressure on defences in the long term</p>
<ul style="list-style-type: none"> <li>- the railway line between Dyfi Junction and Pwllheli:</li> </ul>	<p>There are several sections of the line that may not in the future be sustainable, particularly where the railway runs across the flood plain or behind or across soft natural defences. The need for realignment is highlighted in several of these areas potentially affecting the entirety of the route. (epoch 1)</p>
<ul style="list-style-type: none"> <li>- the road system to and through Beaumaris</li> </ul>	<p>The potential need for long term change is highlighted</p>
<ul style="list-style-type: none"> <li>- the road and rail links along the north Wales coast and across Anglesey to Holyhead.</li> </ul>	<p>This route would be maintained but there are areas where there would be joint benefit in management of other assets.</p>
<ul style="list-style-type: none"> <li>- the road and rail links along the Conwy valley and through to Llandudno.</li> </ul>	<p>Realignment of the route along the Conwy Valley would be necessary to sustain the service provided.</p>

Management of the various ports and harbours operations generally falls outside the remit of flood and erosion risk management. However, the SMP does highlight the risk, particularly associated with sea level rise to the various harbour facilities and operation. Furthermore, the SMP highlights that in some areas, continued management of harbour structures plays an important role in management of the shoreline. Overall, the SMP recognises the important value the various harbours and water use facilities adds to the economic value of the area and recommends sustaining these activities. In all areas this continued management and development would be through private or collaborative funding.

Critical infrastructure in general is maintained under the preferred plan, where this is associated with sustaining communities. Clearly, where there is a need for adaptation or potential loss of communities, there may be the need to relocate critical infrastructure services these communities. There is a risk with sea level rise to the main power line on pylons across the Dwyryd Estuary and how this is best sustained will need to be examined in detail.

### *Historic Environment*

In assessing the potential for continued management of the various communities and local properties, sustaining the important historic features and landscape has been a major factor. However, there are a significant number of Scheduled Monuments and areas of important archaeological value that, through their location on the natural eroding shoreline, protection from long term erosion would not be seen as being sustainable or desirable. Appendix E assesses the continued risk to sites and highlights in particular some 72 key features of the historic environment which would continue to be affected by erosion under the plan.

This includes many of the Promontory Hill Forts where even at present, erosion is continuing. It is mainly in the Pembrokeshire area where features are most affected at present. Beyond these southern areas, the impact on key sites tends to be more in epoch 2 or, more frequently in epoch 3. While the plan indicates that it would not be viable to protect in-situ these sites, the SMP does highlight the need for mitigation in terms of recording important information. The difficulty has been highlighted, both in this SMP and in other SMPs around the coast of England and Wales, of ascribing a monetary value to historic features and that mitigation through recording of site details cannot fully compensate for the loss of what are irreplaceable features of the shoreline. Also highlighted is that the availability of funding for mitigation often falls short of the resource that is required.

The intent within the SMP does provide for continued management of the risk to many important historic features, including management of the World Heritage sites. In other areas where adaptation and change are seen as being essential to manage future risk, the SMP highlights the importance of historic features and the need for adaptation to be undertaken in discussion with CADW.

### *Natural Environment and Biodiversity.*

Within Appendix E and through the Habitat Regulation Assessment (HRA) and Water Framework Directive Assessment (WFD), the potential impact of the plan on the various nature conservation objectives has been assessed.

There will be impacts and the SMP has in developing the management of flood and erosion risk considered both where adaptation can be managed to enhance the natural environment or to mitigate impacts within the approach to management. This often includes mitigation of the impact that pressure on the coast due to continued defence may have on the human environment in terms of loss of landscape, loss of beaches and amenity and risks to tourism which is so closely linked to maintaining a healthy natural environment.

Even so there will be impacts under the plan. The HRA has concluded that within the following sites set out in Box 5 there would be an adverse impact on *Natura 2000* sites.

Preferred Plan Box 5. Summary of PDZs where Adverse Effect on Integrity of International Sites is Predicted, Showing Habitat Types Effected and Likely Extent						
Designated Site	PDZ	Habitat Type	Habitat area reduction (ha)			
			Epoch 1	Epoch 2	Epoch 3	
Pembrokeshire Marine SAC	2	Intertidal sandflat	0.76	1.07	0.00	
Pembrokeshire Marine SAC	3	Intertidal sandflat	0.29	0.45	0.39	
Llŷn Peninsula and the Sarnau SAC	10	Intertidal sandflat	4.87	62.01	29.29	
	10	Saltmarsh	1.84	120.16	0.00	
Llŷn Peninsula and the Sarnau SAC	11	Intertidal sandflat	2.72	17.91	17.03	
	11	Saltmarsh	2.36	10.19	15.44	
Llŷn Peninsula and the Sarnau SAC	12	Intertidal sandflat	0.02	11.19	15.73	
	12	Saltmarsh	0.21	5.55	12.42	
Llŷn Peninsula and the Sarnau SAC	13	Intertidal sandflat	0.00	1.19	0.80	
Menai Strait and Conwy Bay SAC	16	Intertidal sandflat	1.21	3.87	3.65	
Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC	16	Intertidal mudflat	0.17	3.3	3.65	
Traeth Lafan / Lavan Sands, Conwy SPA	20	Supporting habitat*	0.00*	0.03*	0.01*	
Menai Strait and Conwy Bay SAC	20	Intertidal sandflat	0.00	0.03	0.01	
<b>na = actual extent unknown but is related to the loss of intertidal habitat identified within the Site for the PDZ.</b> <b>* supporting habitat is related to the intertidal habitat loss in the same unit for the relevant SAC.</b>						

In particular, there will be a shift in transitional habitat composition (particularly the loss or gain of intertidal habitat and the relative ratios of mudflat to saltmarsh). This means that there is a legal obligation under the Habitats Directive to find compensatory habitat to ensure the ecological coherence of the *Natura 2000* (and Ramsar sites) network is protected. Compensatory habitat will be secured through the RHCP; this would be subject to approval by the CCW and WAG, and to approval to the test of “no alternative solutions”, and subsequently approval of “Imperative Reasons of Overriding Public Interest (IROPI) as presented in the HRA”. The HRA indicates that there is significant areas suitable for potential compensatory, though those would also result in losses of freshwater and

terrestrial habitats of the European Sites, though these have been identified and further compensatory habitat areas have been identified as suitable to compensate for these losses.

In some areas, particularly associated with the estuaries, where the overall intent of the plan is to support adaptation in the management of an area; to allow adaptation to develop over time so that use of the area in the future is placed on a more sustainable foundation. This means that there would be the need for the early planning for and adequate provision for the relocation of property and infrastructure and a gradual change in property usage and land use. This needs to be a continuous process of management and adaptation rather than one strictly determined by the nominal periods associated with the current SMP epochs. In this respect the strict application of policies set out by the current epochs within the SMP can be misleading. The intent would be to continue to manage defences such that change is not sudden, mitigating the impact on the communities and the land use as well as upon the significant ecological value of the area. Equally, this transitional management has to be considered a continuous process, not a step change from one epoch to the next. Early planning of this process of change is essential; such that there would be scope for allowing saline intrusion and sediment build up within the currently defended areas, particularly allowing development of a more robust ecological system and the development of transitional habitat consistent while maintaining the overall integrity of the environment. These decisions would need to be based on monitoring and through discussion with landowners and local stakeholders.

The assessment within the SEA (Appendix E) also concludes, with respect to WFD, that the majority of the policies in the West of Wales SMP2 study area will not see deterioration in Ecological Status or Potential of the water bodies and therefore will not fail the WFD Environmental Objectives. There is a potential that Environmental Objectives WFD2, WFD3 and/or WFD4 may not be met in thirteen of the TraC water bodies. This needs to be considered in implementing the Plan

With respect to the important geological features, the likely impact on geological features or exposures is generally limited to HTL policies which could reduce the rate of exposure or erosion of the geological features, resulting in them becoming obscured by vegetation over time. The key geological features often associated with SSSI are generally located away from built frontages, where the policies of NAI generally support the presence of the interest features. Hence for the majority of the study area there are no impacts associated with the SMP policies. The main area where there is the potential for loss of geological exposure and damage to the geological component is in the Glannau Tonfanau / Friog SSSI where erosion rates may be reduced as a result of SMP policy intended to protect the nationally important railway line.

This summary of the Plan attempts solely to highlight the key issues and the benefits brought about by SMP2. This summary needs to be read in conjunction with the main development of the Plan set out in Section 4, the assessment of potential impacts presented in Appendix E and the information provided about the way in which the coast behaves presented in Appendix C.

The final sub - section of this summary highlights the key issues that have to be addressed in taking the plan forward.

## 5.4 Principal Issues Taking the Plan Forward

### Funding

In the more populated areas, and where there is strategic infrastructure, there is, overall, an economic justification, at a national level, to warrant continued defence. Even within these areas, however, at the local scale maintaining the existing line of defence relies on understanding the broader benefits these frontages provide in terms of recreational and tourism values associated with the shoreline. The state of the national economy will be a significant factor in the provision of funding for defences as coastal communities around the entire coast of Britain will all need improvements to defences if their level of protection is to be maintained. This demand may put such pressure on the national exchequer that full grant in aid will not be available to meet the broader requirement of coastal management.

In other areas, the policy to continue to provide defence has a far lower value or direct risk benefit. The SMP, however, recognises that continued defence is important at a regional and local scale and has recommended policies for continued management or realignment to sustain essential values of the coast. In several areas this would only be possible through joint funding with local and individual contributions. Establishing management groups looking in more detail as to how this funding can be put in place will be an important aspect of how the SMP policy is taken forward. While the SMP puts forward a realistic plan for management, it has to be recognised that unless funding mechanisms are put in place, including funding beyond that provided by risk management, then the intent of the Plan will not be realised. Where there is such a risk, the SMP does discuss the consequences.

In some areas, while there might be a basic economic argument for continued defence, in relation to the assets at risk, to do so is not seen as sustainable. This arises primarily from the technical difficulty of ensuring that peoples' lives are not put at risk in the future due to the increased vulnerability of the communities to events exceeding the design standard of defence or to the increased fragility that raising defence levels imposes. This also reflects the impact that defence may have on the coastal processes, the landscape and character of the area or the natural environment.

Moving communities or developing an adaptive approach to major change is a problem that has not regularly been faced in the past. With the anticipated sea level rise of the future, this problem will have to be addressed. This cannot be done solely at a local level, although quite clearly it has to be achieved through discussion with communities at the local level. This is seen as being a major issue that needs to be taken up at a national level. Such planning will take time. There are already plans being developed with respect to the Pwllheli Pilot study. Other areas where quite imminent planning is necessary are at:

Broadhaven and Little Haven, Newgale, Lower Town Fishguard, Borth, Fairbourne, Dinas Dinlle and Bangor. As well at several smaller villages within the SMP area.

Significant funding resource may be required to allow adaptation.

### Transport

As identified earlier there is significant risk to sections of the regional transport system. This needs to be considered at a regional and national level.

### **Nature Conservation**

The HRA has identified significant adverse impact on various internationally designated sites within the area. Potential compensation measures are also identified. In taking this forward this would be subject to approval by the CCW and WAG to a test of “no alternative solutions”, and subsequently approval of “Imperative Reasons of Overriding Public Interest (IROPI)”. In other areas there needs to be adaptive management to secure the integrity of important sites. Such change in management of defences needs to be based on monitoring considering potential trends that would indicate impacts that would occur in the future.

### **The Estuaries**

The estuaries are among the most sensitive and potential most dynamic features of the coastal system. Management within these areas involves complex interaction and interdependencies between different sectorial interests. While the SMP is able to highlight at a high level many of the issues, the detailed management of future management needs to be taken forward through development of local management plans. The aim of the SMP is to provide guidance and to steer the thinking behind these plans. There is already discussion of management for the Teifi, the Dyfi and the Conwy. The SMP identifies the need for such discussion on the following estuaries.

Nyfer, Teifi Dyfi, Dysynni, Mawddach, Artro, Dwyrdd, Alaw, Traeth Coch and Conwy

### **Integrated Management**

The SMP only sets policy for management of flood and coastal erosion risk. However, very obviously, the manner in which the physical management of the shoreline is undertaken has a major impact on the future use of the coast; development of its settlements, management of its natural and historical environment and the opportunity to deliver a sustainable future for the whole area. The recommendations and issues identified throughout the SMP need to be considered, not just where there are changes in policy, through forward spatial planning.

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