3. Basis for development of the Plan

Contents

3 Basis for development of the Plan

3.1 Historical and Current Perspective

3.1.1 Physical Structure of the Coast

There are three main factors which have controlled and shaped the coastline as we observe it in the present day. These are: geology; coastal processes (sea levels, waves etc.); and (more recently) human intervention and management.

The Isle of Wight coastline has been shaped by major sea level fluctuations which have occurred in response to periods of glaciation. During the last cold period of the Ice Age sea levels fell by up to 140 metres. At this time, the Island's Chalk spine would have extended to the Isle of Purbeck in Dorset. As the ice sheets melted and sea levels rose over the period 15,000 to 5,000 years BP (before present), the Chalk ridge was eroded and the valley behind flooded, forming the Solent and separating the Isle of Wight from the mainland. During this period of fluctuating sea levels the Isle of Wight coastline was subject to rapid rates of erosion. The sediments resulting from the erosion of the Island's cliffs were transported to form various sand and gravel banks in the eastern Solent.

The present day northern coast of the Isle of Wight is generally characterised by relatively low-lying coastal slopes, with five estuaries and rivers draining north into the Solent. By contrast the southern coast is generally characterised by steep coastal cliffs and landslides. Hard engineered coast protection structures and sea defences, plus the replenishment of beach material, continue to artificially hold the frontage in a 'stable' form.

Figure 3.1 An overview of the Isle of Wight area (Isle of Wight Council).

A detailed discussion of the geology and coastal processes is presented in Appendix C. A summary of the controlling factors is provided below.

Geology

The solid geology and structure of the Island is dominated by a strong east-west monocline – a Chalk ridge which cuts through the centre of the Island and is exposed at either end to form headlands at The Needles in the west and Culver Cliff in the east. This ridge is the result of tectonic activity 30 million years ago (the Cainozoic era) causing a folding of the Isle of Wight rocks. The sedimentary rocks forming the Isle of Wight are relatively weak and vulnerable to erosion, forming relatively low-lying coastal slopes and estuaries in the north and steep sea cliffs in the south. A prominent feature of the south coast is The Undercliff - an ancient coastal landslide complex extending from Luccombe in the east to Blackgang in the west. The feature is approximately 12km in length and extends approximately 500m inland and nearly 2km seawards. The Undercliff is formed below the Lower Cretaceous and Chalk outlier known as the Southern Downs.

Influence of Manmade Defences

A number of chapters of the Islands coastline have been modified by the construction and maintenance of hard coastal defences; namely Cowes, East Cowes, Ryde, parts of east Wight, Ventnor, Sandown Bay, Freshwater Bay and in the extreme north-west. This means that in some areas natural shoreline dynamics may be altered, which has implications for future shoreline management.

A relatively sheltered and low energy shore unit is identified to extend along the heavily protected coast from Ryde to Nettlestone Point. The regionally significant sediment sink of Ryde Sands fronts Ryde Esplanade and marina backed by seawalls. The coast around Ryde is enclosed entirely by sea-wall structures and coastal slopes appear stable.

With the emergence of the twin resorts of Shanklin and Sandown in the 19th century, installation of substantial sea walls and promenades removed the former cliff line from the direct influence of wave-induced attack. The coastal frontage between Yaverland and Shanklin Chine is fully protected by a variety of structures. These include sea walls, revetments and groyne fields that have been subject to both renewal and extension for more than a century. Immediately north-east of Yaverland the seawall terminates and there is no northwards protection against marine erosion. Although isolated from wave activity by sea defences, the former 40m high sea cliffs along the Sandown to Shanklin coastline remain geomorphologically active to a limited extent, due to sub-aerial weathering and minor mass movement. Various protection techniques including cliff-top regrading, drainage, timber shuttering, geofabric/grass matting, netting, rock bolting and talus reprofiling and removal have been implemented to manage this problem over a 3.5km length, including recent cliff stabilisation works at Shanklin in May 2008.

From Monks Bay to Ventnor the shoreline is stabilised by continuous seawalls with some boulder revetments. Rock revetments are also present from Ventnor and Steephill Cove, with seawalls in the east of this chapter. Defences function directly to halt toe erosion and also to provide support to the toe of the coastal slope to reduce occurrences of instability within the Ventnor Undercliff Landslide Complex. Several cliff stabilisation schemes involving re-grading and drainage have been developed in addition to the general toe protection and weighting. Interventions around Ventnor and Bonchurch appear to have significantly reduced the occurrences of landslide re-activations within the landward terraces.

Most of the north coast of the Isle of Wight is natural but there has been localised shoreline stabilisation by seawalls near the settlements of Totland, Yarmouth, Cowes and East Cowes. Norton Spit at the entrance to the Western Yar Estuary has been stabilised and its sediments impounded such that natural adjustments of this feature are no longer possible.

Physical Interaction

Hydrodynamics

This chapter describes the wider hydrodynamic conditions experienced across the SMP frontage, encompassing wave climate, tides and water levels.

Wave Climate

The wave climate varies greatly across the Isle of Wight SMP coast due to the multi-directional frontage. The dominant wave direction is from the south-west, which corresponds with the direction of longest fetch and longer period swell waves originating in the Atlantic Ocean. Shorter period wind waves from the south-east and east are less influential in terms of geomorphological development along the frontage and are generally limited in duration, although large storms do occur from these directions and can result in significant local impact involving local temporary movement of sediment.

The largest waves (and therefore greatest amount of wave energy) are received by the area of south-west coast from St. Catherine's Point to The Needles. This frontage occupies one of the most exposed locations on the south coast of England with long fetches in excess of 4,000km to the south-west extending directly into the north-east Atlantic as well as shorter fetches to the south across the English Channel.

The east-facing coast is relatively protected from waves generated by dominant westerly winds, although it is subject to the residual energy of swell waves refracted by a combination of offshore seabed topography and the change in coastal plan at Dunnose. It is, however, fully exposed to a fetch distance of just over 200km, extending east and east-south-east within the Channel; over which large waves can be propagated in association with easterly gale-force winds.

The south-facing Undercliff has a maximum fetch of 150km (except at Blackgang, which is directly exposed to Atlantic swell waves), defined by the opposing Channel coast of France, although it is also in receipt of refracted ocean swell from the west and south-west (SCOPAC, 1991/2004).

The Needles headland provides significant shelter to much of the north-west facing frontage from waves approaching from the south and south-west. Despite this, this frontage is potentially exposed to dominant waves approaching from the west and north-west.

Tides

Strong tidal currents are generated in the western Solent and these contribute additionally towards sediment mobility in specific areas. Tidal currents are less rapid in the East Solent (generally $<1ms^{-1}$) compared to the West ($>2ms^{-1}$). Tidal currents are often strong, especially during spring tides and where either the shape of the coast or the seabed contours cause a concentration of the flows. Along the Undercliff coast, tidal

currents are particularly strong in the vicinity of St Catherine's Point, resulting from the coastal topography and seabed depth helping to concentrate flows at this location.

Entry of coarse sediments into the West Solent from Christchurch Bay is normally restricted by tidal conditions at Hurst Narrows. Examination of tidal curves for Lymington, Yarmouth and Totland reveal marked asymmetry, because the ebb flow is concentrated into a shorter time period than the flood (SCOPAC, 2004). The ebb flow is therefore considerably more rapid than the flood and transport of coarse bedload sediments (sand and gravel) is therefore likely to be in a net southeastward direction, parallel to the shoreline between Fort Albert and the Needles, determined by peak current velocities. Dyer (1971, in SCOPAC, 2004) has shown that ebb and flood tidal streams have sinuous courses in the West Solent; thus the relative effectiveness of tidal currents varies spatially, with strongest flows adjacent to meander bends. Locally strong currents are generated by exchange of tidal waters at the mouths of the Western Yar, Newtown Harbour and Medina Estuaries.

Tidal flow through narrow entrances to estuaries and inlets generates rapid currents which interrupt littoral sediment transport causing local circulation effects and associated changes in coastal configuration.

Sediment Sources

One of the principal interactions along the coast (and one that underpins the SMP sediment-cell approach) is that of sediment movement. Such interaction is determined in part by the sediment sources and sinks and in part by the manner in which features described in the chapters above control and modify the behaviour of the coast either directly or indirectly:

- Directly in terms of sediment movement, for example with a down-drift headland acting as a control point allowing the coast up-drift to realign to a stable position but regulating sediment down–drift, ,
- Directly where a restraint determines the position of the coast, restraining movement of adjacent chapters of the coast,
- Indirectly where an up-drift headland influences coastal forces, modifying direction or energy at the shoreline,
- Indirectly where a natural or artificial barrier modifies forces acting at the shoreline,
- Indirectly where forces in the nearshore area are interrupted or redirected.

The SCOPAC Sediment Transport Study (2004) gives an excellent description of the current understanding of sediment transport mechanisms for each of the process units within the SMP frontage.

Broadly speaking, sediment transport mechanisms across the SMP frontage are driven by wave energy. As the dominant direction of wave approach is south to south-west, dominant nearshore transport of sediment is from west to east, in common with much of the wider regional coast. There are occasional exceptions to this dominant regime in the vicinity of the harbour mouths and headlands.

Marine erosion has continued around most of the Island to produce a near-continuous cliff line that varies greatly in terms of morphology and rates and styles of weathering and landslide activity. The south coast in particular is vulnerable to large storms

crossing the Atlantic and rates of erosion are particularly rapid in the softer Wealden rocks along the south-west coast of the Island. The exposed (high energy) southern coasts also allow greater potential for shoreline sediment transport compared to those along the sheltered environments of the Solent to the north.

Whilst the direction of dominant littoral drift is generally a simple correlation with the dominant wave climate (particularly where tidal range is small and currents are weak, as is the case within most of this SMP frontage), the magnitude of littoral drift has a more complex relationship with the wave climate. It is a product of many more factors, including wave height, wave period, nearshore bathymetry, particle size distribution, relative cohesiveness of beach and shoreface sediments, plus the influence of tides.

The picture of offshore sediment transport across the whole area is complex and by its nature is less well understood than the nearshore littoral transport.

Sediment Supply

There are distinct differences between the exposed southerly and westerly facing coasts (potentially rapid marine erosion) and the relatively sheltered north coast (more modest toe erosion), although in both areas erosion can trigger a degree of further slope failure and retreat. Cliff erosion materials deposited on the foreshore are valuable inputs to the immediate littoral system and also contribute to beaches further downdrift. Cliff sediments provide more permanent protection of the cliff toe if they are sufficiently durable to remain on the local beach and are not removed by littoral drift. In spite of continued cliff erosion sediment inputs, local beaches are not large, suggesting that most materials continue to be removed and that the Island's beaches are open systems dependent upon continued inputs for their stability and even survival. Since sedimentation is generally confined to Ryde Sands and limited areas at small spits or within the estuaries, the Island apparently functions as a sediment source or donor to other areas including the offshore zone.

Around the coast of the Isle of Wight, seabed sands and gravels are highly mobile during peak flow conditions, with a general eastward transport of bedload sediment. In sites where this general trend is interrupted, for example at Thorness Bay and Hurst Narrows, sand and shingle banks have formed.

Given the importance of the cliffs in sediment supply terms, an important part of the overall plan is to allow continued erosion of the cliffed frontages wherever possible. This also helps to satisfy a number of high level SMP objectives. Generally this approach is not detrimental to designated environmental sites because allowing natural erosional process to continue and maintaining geological exposure is key to their citation.

Beach Recharge

Another consideration for this SMP review is the sediment made available by beach recharge activities. Beach recharge introduces new material to the frontage (as opposed to recycling and/or reprofiling which moves existing sediment around within a given sub-cell). However recharge actually represents a small input of new material to the SMP frontage.

The small scale recharge activities have been concentrated in the region from Bembridge Point to Forelands Fields where several small-scale beach recharges have also been practised since the 1980s.

Limited beach nourishment has been undertaken in the past at several locations in response to falling beach levels so as to temporarily prevent undermining of coast protection structures and reduce the historical trend of inter-tidal narrowing (Halcrow, 1997). In all cases, volumes are small and designs governed by the perception of critical losses rather than thorough and systematic long term monitoring of beach profiles and volumes. The main sites are:

- Yarmouth Pier to Yarmouth Common: Small scale gravel replenishment was introduced in response to falling beach levels east of Fort Victoria (Hydraulics Research, 1977a).
- Norton Spit: Stabilisation of the spit by groynes and revetments and ad hoc reinstatement of beaches by gravel nourishment/replenishment (Lewis and Duvivier, 1981; Barrett, 1985; Posford Duvivier, 1989a) has been undertaken over the past 25 years.
- Fort Victoria: Co-ordinated shingle replenishment and groyne construction occurred immediately east of Fort Victoria, to prevent shoreline recession affecting the coastal access road (Lewis and Duvivier, 1981; Barrett, 1985; Posford Duvivier, 1989a). The source materials were predominantly rounded pebbles from Solent Bank, and other marine sources.
- Old Castle Point to Shrape Breakwater, Cowes Harbour entrance.

Dredging

The entrances to the Western Yar and Medina Estuaries have been dredged to maintain navigable channels for car ferries. Dredging at estuary entrances and within the main West Solent channel represents a net output from the sediment budget and may result in loss of sediments that might otherwise be transported to shorelines. Dredging of Yarmouth Harbour entrance has been undertaken for navigation purposes and in 2009 a trial of beneficial use moved the dredged shingle to the north of the breakwater in order to keep the sediment in the system and help to defend the breakwater structure.

Solent Bank, a major gravel and sand accumulation within the Western Solent, has been denuded of sediment by aggregate dredging over the period 1950-1990. This intervention has resulted in removal of around 10 million m^3 of material, with consequent lowering of the bank by over three metres. The impacts of these actions are difficult to determine although wave shoaling and refraction could have been affected (primarily at low tide).

Coastal Change

The coastal zone is a dynamic environment, reliant on natural process to form the boundary between land and the sea.

Along the Dunnose to The Needles coastline, the main pressure for change has been cliff erosion and slope failure. In the recent geological past, large scale erosion has produced large quantities of sediment which has allowed the development of the sand and shingle shoreline seen today.

Along the south-west coast rising sea-levels of the mid to late Holocene re-occupied former degraded cliffs initiating renewed erosion of its soft Cretaceous sands and clays to form a rapidly retreating linear or slightly embayed cliff coastline some 15km in length. As the coast retreated it has produced a shallow nearshore shelf, or shore platform extending seaward for some 4km which is thought to indicate the extent of late Holocene coastal recession.

The coast between Culver Cliff and Dunnose has developed through marine erosion of the predominantly soft clays and sands of the Lower Cretaceous strata and Upper Cretaceous Chalk. Erosion would have operated over the past 5,000-6,000 years, since the rising sea-level has approached its present elevation. Extensive shore platforms provide evidence for long-term recession in outcrops of more resistant bedrock, and appear to extend seawards of low water. In total, several kilometres of recession have occurred; sufficient to release large quantities of predominantly sandy sediment.

The north coast of the Isle of Wight comprises the north facing valley side of the former Solent River that became occupied/re-occupied by marine inundation 7,000 to 8,000 years before present. It is generally more exposed than the corresponding mainland shore to waves and tidal currents. Erosion has therefore prevailed of the toes of coastal slopes formed in soft Palaeocene, Eocene and Oligocene clays and mantled by relic landslides. In this situation the slopes and cliffs are inherently sensitive to erosion and renewed landslide activity, even when the driving marine forces are relatively weak.

Coastal Change Policy

Planning Policy Statement 25 (PPS25) on Development and Flood Risk (revised in March 2010) sets out the Government's spatial planning policy on development and flood risk. The PPS25 Development and Flood Risk -Practice Guide was published in December 2009, complementary to *PPS25 Development and Flood Risk* and providing guidelines on how to implement development and flood risk policies by the land use planning system. In March 2010 Communities and Local Government (CLG) released the PPS25 Supplement: Development and Coastal Change. It replaces the policy on managing the impacts of coastal erosion to development set out in Planning Policy Guidance 20, Coastal Planning. This sets out a planning framework for the continuing economic and social viability of coastal communities and aims to focus on managing risk against the impending impacts of climate change in coastal areas.

One aspect of coastal change policy with specific relevance to SMPs is the identification and establishment of 'Coastal Change Management Areas' (CCMAs). Where the preferred plan and policy choices within the SMP indicate that a discrete area will undergo significant change, it may be useful to identify these as potential CCMAs. Although it is not clear yet on precisely the criteria which will be used to identify CCMAs, any location likely to undergo significant morphological change, loss of property, relocation of chapters of the community or require major realignment, (including transport links and so forth) may potentially be flagged as a CCMA.

In 2009, Defra launched a consultation setting out ideas for how coastal communities can successfully adapt to the impacts of coastal change and details of the new coastal change pathfinder programme. This programme supports communities in developing and implementing adaptation techniques to coastal change and when successful can be rolled out at a national level. A coastal change fund of up to £11 million is supporting the work.

Climate Change

Sea level rise, increased wave heights and increased severity and occurrence of storms are the principal results of climate change that impact on the coast. Sea level rise is predicted to add up to a possible 1.0m to mean sea levels by the year 2105 from baseline mean sea level taken from 1990. Sea level rise of this magnitude could impact greatly on the entire SMP coast. The current trend for sea level rise which is based on the long-term record from Newlyn (1916 – present) is just under 2mm per year.

Due to the physical mechanisms involved in raising sea levels, particularly thermal expansion of the oceans (which lags behind changes in atmospheric temperature changes), there is not a smooth linear increase in sea levels, instead an accelerating growth curve is expected. Therefore the increase per year becomes more severe as time progresses and risks increase accordingly.

The principal guidance currently used for sea level rise was released by Defra to operating authorities in October 2006 (Flood and Coastal Defence Appraisal Guidance; FCDPAG3 Economic Appraisal; Supplementary Note to Operating Authorities – Climate Change Impacts; Defra (October 2006)). These values have been used in calculating the future flood extents for 2025, 2055 and 2105. Table 1 below sets out the allowances provided in the guidance.

South-east England	Net sea level rise in mm/yr
1990-2025	4.0
2025-2055	8.5
2055-2085	12
2085-2115	15

Table 1: Sea level rise predictions published by Defra in 2006 as a supplementary note to Operating Authorities, defining the sea level rise allowances to be used in coastal management schemes and plans, including the SMP2 review.

Based on the above values, the following amounts of sea level rise are calculated for the SMP frontage, used in the development of this Shoreline Management Plan. The amounts of predicted sea level rise (in centimetres) are displayed as increases above the standard 1990 baseline sea level, or alternatively as increases from the start of 2009, until 2105:

Epochs	Sea level rise in cm:	
	From 1990 (standard baseline):	From 2009:
By 2025	+14cm	+7cm
By 2055	+39.5cm	+32cm
By 2105	+105.5cm	+98cm

Table 2: Sea level rise predictions for the Isle of Wight (based on Table 1).

The SMP2 flood mapping draws on the 2009 Isle of Wight SFRA –Tidal Climate Change Mapping Update (courtesy of Entec UK Ltd. & Isle of Wight Council Planning Services, September 2009), with work by Royal Haskoning for SMP2. In future, where appropriate, the Environment Agency Extreme Tide figures could be utilised as a data source by implementation activities (eg. in Coastal Defence Strategies). The SMP2 assessment has used baseline flood and topographic data generated by the

Environment Agency and taken account of the sea level rise allowances shown in Table 1 to provide potential water inundation outlines and assess future risks. Further information is provided in Appendix C3.

The flood zones show the areas that could be affected by flooding from the sea, if there were no flood defences in place. In chapter 4, the introductory map for each PDZ shows the current tidal Flood Zone 3. Flood zone 3 shows the area that could be affected by a flood event that has a 0.5 per cent (1 in 200) or greater chance of happening each year. The Management Area Statement maps provided at the end of chapter 4 show the current tidal Flood Zone 2. Flood zone 2 shows the area that could be affected by an extreme flood from the sea, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

Defra (2006) have also released guidance to operating authorities advising them to allow for extreme wave heights to increase by around 10% during the period to 2100. Allowances for offshore wind speeds are also increased by a factor of 10%. These allowances are based upon the predictions made by the UK Climate Impacts Programme (UKCIP). It is also possible that there may be some changes in the prevailing wind directions but this remains an uncertainty.

It is important to note that the Defra October 2006 guidance figures on allowances for sea level rise are intended primarily to act as guidance for the design of new schemes and defences. Therefore there is a certain amount of precaution built into the figures.

During the production of this SMP, the UKCP09 Climate Change Projections were released (http://ukclimateprojections.defra.gov.uk/). The sea level rise predictions contained within that report were considered during the SMP development however continued use of the 2006 figures as the primary sea level rise guidance is consistent with current guidance and consistent with other SMP reviews. Further information can be found in Appendix C1-Annex B (section 4.2).

Confidence and Uncertainty

The study of coastal behaviour and processes is far from being an exact science. Records and data can be assessed to determine particular trends to gain an understanding of how the coastline is changing. However, due to the highly sensitive and responsive nature of coastal process, there are uncertainties when predicting erosion rates and sediment movement. The Isle of Wight has excellent coastal monitoring records; however this can still be regarded as limited data when considering the longer term, particularly where cyclical processes are involved. The erosion zones presented within the SMP are to be treated as indicative lines, as they are predictions based on present day understanding. This information should therefore be regarded as supporting data for policy development and not as absolute lines of coastal erosion. For the purpose of planning 100 years in advance, a large number of uncertainties remain.

However, such uncertainty is far more related to timing of events such as erosion rates and far less in the understanding that erosion and change will occur. One such obvious uncertainty is in the rate of sea level rise, which strongly influences erosion rates.

At a more local scale there is uncertainty as to the response of the estuaries to sea level rise. Sediment availability and increased fluvial flows (resulting from increased rainfall linked to climate change) will also be influential in shaping the estuaries in the future.

National Coastal Erosion Risk Mapping
Assessment and mapping of coastal change and erosion risks (at a national scale) is underway through Defra's National Coastal Erosion Risk Mapping (NCERM) project. Although it is envisaged that the outputs from this study will not be available until 2011, the work indicates the ongoing effort to reduce uncertainty and manage the residual risks inherent within coastal erosion. The mapping of erosion and establishment of erosion risk zones through the work of the SMP should assist in refining the outputs of the NCERM.

Conclusions
Considering the importance of the coastline, from both a natural and human perspective, there is a clear need for management in order to sustain this environment for future generations. The SMP is essentially a mechanism for creating a plan of intent, such that future strategies and schemes can consider the broader scale of the coastal zone. The plan has largely achieved a balance between human aspirations and natural process, in such a way that there is opportunity for sustainable management for the next 100 years.

The coastline is a dynamic environment and is constantly changing and there will be continued pressure from erosion. The relatively hard geology which dominates coastal behaviour along the western and eastern headlands of the frontage will continue to do so, but even here erosional pressures require policy to deliver an integrated approach in planning for a sustainable position for the coastline. The chapters of the coast where there is more resistant high ground or major geomorphological features have allowed the coast to develop a relatively stable alignment to the dominant wave energy.

Notwithstanding the uncertainties, the SMP can project forward the behaviour of the coast in the short term and in many areas through to the medium term. The SMP can also predict with a degree of confidence the longer term general behaviour of the coast, identifying where there is evident long term change and pressure. However, the uncertainties are recognised to be important and the SMP has to acknowledge this, particularly with respect to timescales. This projection forward is important, as management decisions made now will influence longer term trends and the long term sustainability of management.

The SMP is putting forward a plan for managing change in a sustainable way taking account of the overall physical structure of the coast and man's influence on this structure and behaviour.

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

The aim of the SMP is to ensure that a proper account is taken of the impact of interaction between areas, such that management in one area does not have a detrimental impact elsewhere. Typically this implies the need to consider the reliance on defences, the erosion rate or cliff stability on secure beach levels. From this, and from the broader picture of the sediment supply (potentially from the nearshore and offshore areas and from erosion of the land), there is the need to consider 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 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.

3.1.3 Natural and Cultural Heritage

Appendix D (Thematic Review) provides a detailed definition of the natural heritage, landscape, historic environment and land use. The following paragraphs draw this together in a general appreciation of the values of the area.

Geology

The SMP shoreline is highly diverse in terms of its natural and cultural heritage; those aspects of the coastline that give an essential and important quality and backdrop to the current use and appreciation of the area.

With respect to geology, this has already been discussed (chapter 3.1.1) in terms of the physical structure. However, the coastline has been described as an area where geological processes, in particular erosion of the coastline cliffs, should be valued. It creates a landscape which is major attraction for visitors and a key element of the tourism-based economy.

Geological Sites of Special Scientific Interest (SSSIs) in the study area are extensive and cover the majority of the cliff frontages, Chines and ledges along the Isle of Wight coastline. Such areas are significant for research, in understanding the very long-term perspective of change, for education, in developing an appreciation of this change, and for enjoyment of the varied landscape, habitats, flora and fauna. In addition to this general collection of varied interest, reflecting the diversity along the whole coast, are the more specific sites, focussing on such aspects as palaeontology. These specific qualities are recognised in the extensive range of designations at international, national, regional and local levels. The Isle of Wight is recognised as an important source of Cretaceous Dinosaur remains.

Heritage

As significant as the geological history, is the long-term occupation of, and activity on the coastline, including what was once land but has now been lost to flooding and erosion, and where other areas have developed into the coastal environment inhabited today by our coastal communities. The historic landscape of the coast, shore and intertidal zone and its component features demonstrates the extent to which human communities have occupied and used the coast, sea and shore over thousands of years. Present and submerged landscapes and deposits hold vital and irreplaceable evidence of the development of the landscape and seascape and the strong influence of past communities in shaping and exploiting the shoreline. The management of this heritage is therefore critical in sustaining the social and historical values of the coast.

Heritage contributes vitally to local character not only underpinning community identity, but also acting as an attraction for visitors and a key element of the economic benefits of tourism. The coast here boasts many buildings, sites and monuments of national or regional interest.

The key archaeological assets, in particular Scheduled Monuments (SM) and historic and palaeoenvironmental sites, considered within the Isle of Wight SMP2 are associated with the areas of Cowes, Wootton-Quarr, Ryde (and surrounding villages), Bembridge,

Ventnor, Yarmouth, Bouldnor and the north-west coastline including Newtown. Archaeological remains are a finite and non-renewable resource, highly fragile and vulnerable to damage and destruction. Upstanding and buried remains need to be protected and managed sympathetically within new development. Coastal change reveals unique palaeoenvironmental archives in the intertidal and subtidal zones.

This type of history is important in understanding the area and its development and, in particular along this chapter of the coast, the way in which man's use and values have adapted to or been altered by the changing coastline. In addition to the important cultural and educational context, the varied assemblage of heritage interest supports the significant tourism industry.

In some areas, sites or monuments are at risk from erosion or flooding. As an overall approach within SMPs, the objective is not to defend every site or monument, but to identify those which are most at risk, so that prior survey and recording can be undertaken before the sea encroaches and destroys them. Each area does have to be considered on its own merit. There are areas where the heritage value is embedded within present day values of our existing settlements and there are features where their context within the coastal zone is essential to understanding their value and where they contribute importantly to the overall historic landscape character of the coast. While an underlying principle, in line with that of the SMP as a whole, is to minimise reliance on defence, the SMP also has to consider the opportunity to sustain the historic environmental values in an appropriate manner.

Natural Environment

The Isle of Wight coast includes long chapters of natural, undeveloped coastline, with chapters being characterised by sand and shingle beaches, soft cliffs, low-lying marshes, reedbeds, reclaimed tidal land, heathland, forest and farmland. Each of these habitats in turn supports a range of species of high conservation value, including those listed on Annex II of the Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora). The high conservation value is reflected in the fact that the majority of the coastline, even with significant areas of development, is subject to statutory nature conservation and landscape designations, which have had important implications for the Isle of Wight SMP.

Along the Isle of Wight coastline there are several areas of International and European conservation importance, with these designations being underpinned by national legislation. Areas of conservation importance with pertinence to the SMP process are detailed in Appendix D and the SEA.

The variety of habitats fringing the coastline has presented paradoxes for shoreline management; areas of freshwater habitat were of a coastal nature prior to reclamation, with these areas now being located either at, or below, mean sea level. As such, the development of SMP policy for these areas has attempted to provide for the most sustainable future management of these areas, with the effects of policy having been assessed through both the SEA and AA processes.

In this context 'sustainability' is assessed based on the ability to maintain the shoreline in its current position without adverse impacts. Where it is not technically sustainable to hold the line along a given frontage, the objective to establish a long-term sustainable position for the shoreline dictates the policy. In this case the plan is seen to achieve

sustainability for the shoreline per se, but it is acknowledged that this may not represent sustainability for a freshwater habitat above current MHW. However, the sustainability of such habitats cannot be guaranteed when residual risk is allowed to increase seaward of the defences and the risk of substantial overwhelming of defences and inundation of freshwater areas results.

Landscape

All the above interests contribute to the exceptional landscape value of the coastline. The Isle of Wight coast conjures images of sand and shingle beaches, shingle ridges, sandy spits, high Chalk cliffs, the wide open but sheltered harbour areas and the imposing presence of the Needles. In many ways this landscape quality draws together the many aspects and activities associated with the coastline, and in turn provide a valuable asset both to local residents and to the regional economy through tourism.

3.1.4 Human (Socio-Economic) Environment and Activity

The Isle of Wight coastline has a unique and dynamic nature, underpinned by the diversity of values found along the coast. These values provide the fundamental building blocks in determining the intent of the management plan. The values range in both scale and function, from the major urban centres of Cowes and Ryde, to large areas of open space used for both agriculture and recreation. Other key features comprise the thousands of homes and businesses that are situated along the coast, together with a heavy dependency on tourism for further communities such as, Sandown and Shanklin, Yarmouth and Ventnor. These are some examples of how people are interacting with the coastal environment both at present, but also historically through the numerous heritage sites and scheduled monuments along the coast. These features and issues can be found within Appendix E. Although each value is specific, many features share common grounds; whether it is proximity to one another, or multiple functions/interests of an individual feature which appeal to a variety of stakeholders. In developing the SMP it has been important not just to capture the mass of individual features but to acknowledge the manner in which these values and interests interact. This has been attempted in defining the broad level stakeholder Objectives, which form the basis of the policy development process. These are found within the Policy Development Zone discussions within chapter 4 of this report.

In considering these objectives it is important to appreciate that these values are not fundamentally in conflict but act to support the overall socio-economic aspect of the area.

There are specific important activities essential to the welfare of the area. The Isle of Wight is reliant on ferry service links to the mainland, an essential component of coastal infrastructure. Major port and sailing activities are centred at Cowes, which along with Ryde, Sandown and Shanklin are popular bases for tourists and visitors and rely heavily on commercial and recreational activities.

The majority of settlements on the Isle of Wight are located around the coast and rely on the infrastructure of the local road network including cliff top roads linking communities on the coast. In several areas these roads are at risk from erosion, in particular the

Military Road along the south-west coast, and from tidal inundation along the Western and Eastern Yar valleys.

The SMP process has to consider all such aspects balancing the possible difficulty of maintaining the socio-economic structure against the continuous change and erosion along the frontage. An important role of the SMP is to examine how these various communities can be sustained in the context of an eroding coast. Equally important, however, is to reflect what it is about each centre that is important, so that in maintaining defence to an area, or in considering the need for change in defence policy, the values of the coastal frontages are equally maintained. This requires a long term view to be taken, considering how management of defences may be best adapted to longer-term changes and the threat of sea level rise and climate change.

3.2 Sustainable Policy

A SMP, therefore, 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 statement 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 coastal defence management policy as avoiding: "*tying future generations into inflexible and expensive options for defence."*

While this provides an initial intent, encapsulating the long-term view being taken by this 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 chapters 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 resisting erosion or changing the coastal form; and
- 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 Isle of Wight SMP coast have been identified from the following sources of information:

- Earlier studies, such as the first SMP, Strategies and scheme studies;
- Stakeholder meetings and responses from key stakeholders, elected members and the Client Steering Group;
- Policy documents, structure and local plans.

The most sustainable approach is to not intervene on the coast and to let it respond in a dynamic way to natural processes occurring along the coastline, although this depends on the harm or benefit resulting from the outcome. 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 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.

The right balance needs to be achieved between these two extremes, at the same time as 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.

3.2.1 Natural Processes

The geological exposures of the coast are clear evidence of how sea levels in the area have changed. Over the last 2,000 years, this change has been quite minimal. However, we are now entering a period of accelerating sea level rise that will impose greater pressure on the coast to erode and could in some areas result in significant change (particularly where the shoreline is dependent on natural protection provided by beach material). There is also the potential for changes in sediment supply. This problem has been exacerbated across much of the SMP frontage over the last century due to human intervention reducing the contemporary sediment supply from cliff erosion by the construction of coastal defences. Although attention is focused upon the shoreline position, this process also has the potential to produce a deepening of the seabed at any particular point. 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 chapters 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 where this is possible, either through setting back defences or through modifying the approach we take. Equally we need to recognise the importance of the geomorphological control that exists at 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 a 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.

3.2.2 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 2 and 4 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 an area is economically defendable could well shift. 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 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 and heritage may be passed on to future generations. This is not just in the bricks and mortar that is being defended but is

the character and vitality of the coastal communities. There has to be, therefore, 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 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; and
- How management practice will itself evolve. For example in moving down one course of action will this lead to further defence, and further resource being put into defence.

In this latter case the SMP attempts to identify where there is a need to possibly take earlier action to adapt or to take advantage of existing 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 our actions now, and therefore the consequences, 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?

3.2.3 Natural Environment

The forces of nature have created a variety of landforms and habitats along the Isle of Wight SMP coastline. The special quality of the natural habitats and geological/ geomorphological features on this coast are recognised in a number of national and international designations, protected under statutory international and national legislation, as well as regional and local planning policies. 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 Defra High Level Target for Flood and Coastal Defence (Target 9 – Biodiversity) also requires all local councils and other operating authorities to:

- Avoid damage to environmental interest;
- Ensure no net loss to habitats covered by Biodiversity Action Plans; and
- Seek opportunities for environmental 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 a natural coastal defence, e.g. mudflat and saltmarsh environment, which in turn protects intertidal habitats on its lee side. 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 change, 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.

The natural environment of the SMP 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 both the *natural* and *built* environment co-exist on this dynamic coastline.

3.3 The Scale of SMP2 Review

It is evident from chapter 3.1 above and Appendix D that there is a high degree of diversity over the SMP2 coastline. This is in terms of the physical processes, natural and cultural heritage and socio economic drivers; and in considering sustainability (chapter 3.2) that there is significant interaction within each theme and between the different themes or individual sectors of interest.

The aim of the SMP is to provide an assessment of flood and erosion risk at a regional level to then be assessed at national level in regards to affordability, and associated with this, an indication of the overall level of commitment to defence in the area. 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. This is then used by operating authorities to inform other statutory plans and provide clarity of the future drivers of coastal management. 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 chapters of the coast in detail within which individual policy units can then be derived. In taking such an approach, consideration has to also be given to the higher level issues, such that the interaction between these is not lost.

The consultation undertaken at the start of the SMP allowed issues to be identified for individual features within the area, providing an insight to what the public regard as the key values of their coastline. This was used to develop an overall characterisation of the coast, which in turn assisted in forming specific objectives for management. Consideration of this overall characterisation allows the coast to be divided into chapters, through which more detailed consideration could be given to the development of policy. This process is discussed in chapter 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 chapters.

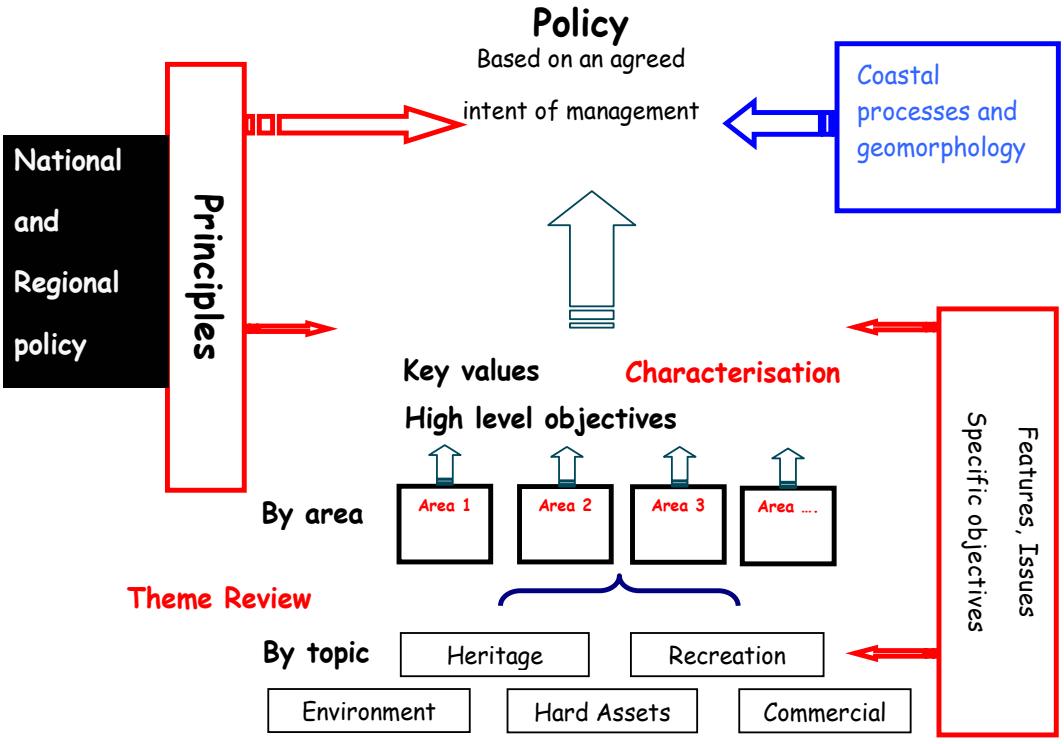

Figure 3.2 Schematic of SMP2 Policy Development

3.4 Development of Policy

3.4.1 Derivation of Policy Development Zones (PDZs)

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 chapters. 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 chapter of the coast and the adjacent chapter, but also to ensure that in developing and discussing policy, all major interactions across all themes are able to be considered. It is within these chapters or zones that individual policy units may be developed. The high level division is shown in the figure below. This division is not intended to define hard barriers along 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 chapters are called, merely as a matter of labelling and convenience, PDZs or Policy Development Zones. Below are the seven PDZs identified for the Isle of Wight SMP2.

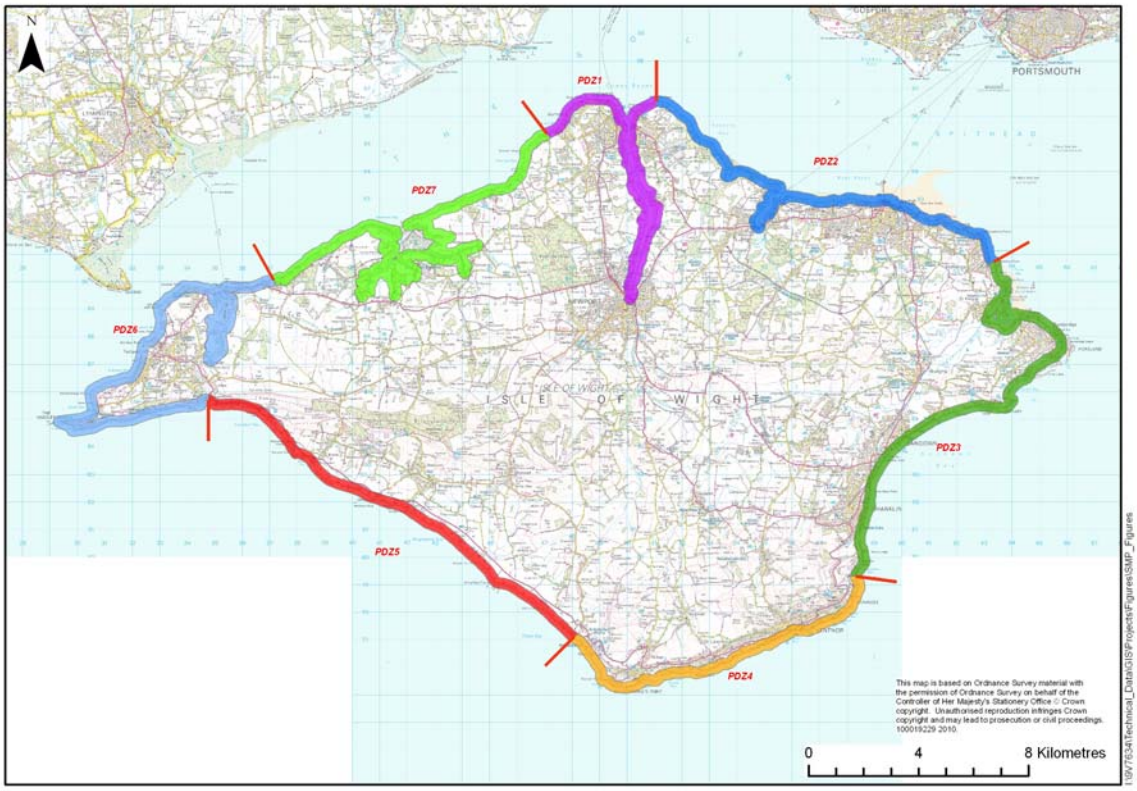

Figure 3.3 Isle of Wight SMP2 PDZs

3.4.2 Identification of Policy Units (PUs)

Within each PDZ different scenarios are considered; always starting with the policy and consequences of 'No Active Intevention' (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 the following Strategy studies. The second scenario therefore assesses the consequences of continuing 'With Present Management' (WPM) –i.e. the policy which the SMP2 is reviewing[1]) and provides the starting point for considering future management. This WPM scenario considers a series of policies for individual lengths of coast within each PDZ. Within any PDZ these individual policies may be different along the shoreline, such that one length may be to hold the line, in a different length the policy may be for managed retreat.

The two initial scenarios (NAI and WPM) are compared and the way in which they allow the coast to develop and the manner in which they meet or fail to meet the objectives defined within the SMP2 is considered. For some chapters of coast the scenarios may 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

[1] It is recognised that the purpose of the SMP 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.

management. In such cases alternative scenarios are then considered, looking how best to deliver the objectives of the SMP.

From this approach either the WPM policies are confirmed or new policies developed for individual chapters of the shore. A preferred defence policy is then defined for a specific chapter of the coast. This chapter of coast is the policy unit. This defines how that chapter of coast should be managed over the lifetime 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, the maximum benefit being sought from existing defences, 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 time. Policy for each unit is therefore defined over time periods or epochs; 0-20 years (short term), 20-50 years (medium term) and 50-100 years (long term).

The aim of developing policy for individual units of the coast within the framework of the PDZ is to ensure a coordinated approach in that the broader implications of managing one Policy Unit with respect to another are considered; hence the scenario approach. These implications are discussed in the process of developing policy within chapter 4 of this report. 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.

3.4.3 Management Areas (MAs)

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 coastal frontages for which a specific defence management policy (NAI, HTL, MR and ATL) is defined. However, as discussed above there may be dependencies between Policy Units (for example to justify a policy of retreat in one area may be on the assumption that an adjacent chapter 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 (MAs). It is within these MAs that the overall intent of management of the coast can best be described.

The definition of the MA 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:

Within each 'PDZ' the coast has been further sub-divided into a series of 'Management Areas' and within each of these management policies have been selected for a co-ordinated series of 'Policy Units', as schematised below:

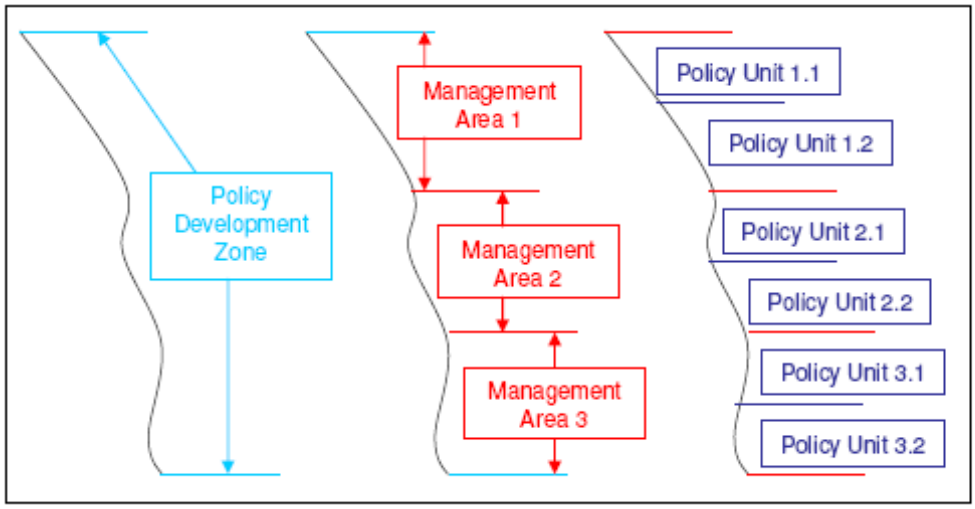

Figure 3.4 Schematic of SMP2 links between PDZ, MA and PU.

3.5 Policy Development Zone (PDZ) Analysis (provided in Chapter 4)

The analysis and discussion for each zone aims to provide an understanding of the issues and nature of the area in a manner which is logical and rigorous and which may be referred to and understood by both coastal managers and people who use or live on the coast. Each PDZ is presented as a series of reports in Chapter 4. Each zone is presented in a standard approach, in line with the SMP guidance. Within each report information has been set out in three chapters:

- Overview and description;
- Baseline management scenarios;
- Discussion and detailed policy development.

These are explained below:

1. Overview and description

This chapter describes where things are and what they are, in terms of the underlying physical nature of the coast, existing defences and features, together with the use being made of specific areas. This chapter aims to set the scene, starting to pull together the overall picture.

Principal Features

The initial chapter provides a brief overview of issues relating to the coast, describing features of the built environment, heritage, amenity, natural environment.

Key Values; Objectives; Description

Within this first chapter is a summary of the key values of the PDZ, a list of stakeholder Objectives quite specific to the zone, and an overall illustrated description of the area. The objectives and principles attempt to summarise the overall aims derived from the more detailed list of objectives in Appendix E, and are used in the following discussions to assess the implications of SMP policy.

Physical Processes

Coastal Processes: A brief description of how the coast is behaving is provided, including coastal processes, wave climate, geomorphological controls, sediment supplies and transfers, 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. More detail on the physical processes is provided in Appendix C1.

Unconstrained Evolution: Although recognised to be a totally theoretical scenario where there has been or 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 impacts 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.

Existing defences: The existing coastal defence structures present in the area are described. Full detail of the defences is provided in Appendix C2.

Potential Baseline Erosion Rates: A summary of erosion rates for different sections of the coast within the zone is provided.

2. Baseline Management Scenarios

Present Management

A description and table is provided setting out the SMP1 policy for various frontages together with further information where Strategies or studies have provided more detail, or changed the present management approach.

Baseline Scenarios for the Policy Development Zone

The chapter provides a description and assessment of the two baseline scenarios for the whole zone, drawing on the current defences and current management. This starts with the NAI scenario and then considers the current management scenario. Appendix C3 provides supporting information listing the NAI & WPM scenarios in detail. In many cases past management has 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 NAI is to identify what would be at risk if defences were not maintained. In a similar way WPM aims to examine how the coast may develop, identifying where there are benefits in this management approach and where there may be issues or pressures arising in the future. Associated with each scenario is a summary of the key risks. This provides a headline assessment of how each scenario achieves the key Objectives set out in chapter 1 of the PDZ description.

Tables are also provided which summarise the economic damages likely to arise from future coastal erosion and tidal flooding. A table also summarises achievement of the Objectives assessed and described in the scenarios above.

3. Discussion and detailed policy development

This chapter builds on the two baseline scenarios to consider specific issues in more detail, looking at both the long term implications of the current policies and also stepping back from local areas to consider any impacts on the coast as a whole. Where the

current policy is felt not to fully 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 areas outside the development zone being considered. For example, it may discuss clear specific challenges and adaptations in how 'WPM' could be delivered. 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 set, including how policy can allow adaptation over the short and medium term.

Management Areas: Policy Units are grouped as Management Areas, providing coherent intent as to the management and dependencies over the area.

3.6 Management Area Statements, including Policies (provided in Chapter 4)

The policy units and management areas are developed in the analysis described above. The final chapter of each PDZ chapter within chapter 4 provides Management Area Statements. The format for this summary is based on the PU summary suggested by the procedural guidance. However, because of the nature of the coast and in many cases because distinct policy units have an association and cannot really be managed independently; the policy summaries have been developed by management area. A summary or statement is presented for each Management Area. These summaries should be read together with the more detailed information given in the main body of the PDZ report.

Each Management Area Statement is set out in the following manner:

Predicted shoreline mapping:
A map summarises the anticipated position of the shoreline in 100 years under the two scenarios of "With Present Management" and under the "Draft Preferred Policy" being put forward through the Shoreline Management Plan.

Summary of Preferred Plan recommendations and justification:
Plan: A description of the preferred plan recommendations is presented providing the clear intention of management of the area, together with an overview of implementation for the short and medium term, as well as the long term intent.

Preferred policy to implement plan: A table summarises the present day, medium and long term intention of the preferred policy.

Summary of specific policies: Policy Units are confirmed and specific Policies set for each unit, including accompanying wordings of specific relevance.

Changes from Present Management: The essential changes from current management are highlighted.

Implication with respect to the built environment: A summary of the economic damages and costs associated with the Policy options is provided.

3.7 Policy summary of preferred Plan and implications: (provided in Chapter 5)

This chapter of the SMP provides an overview and summary of the preferred plan and preferred policy choices to implement that plan. A table compares previous shoreline management policies (from SMP1 and Coastal Defence Strategies) against the new preferred plan policies in SMP2. Importantly this chapter also aims to emphasise the implications of the preferred plan at each location, based on an assessment against five themes: Property and Land Use; Nature Conservation; Landscape; Historic Environment; Recreation and Amenity. Each of the 15 Management Areas and 61 Policy Units identified previously in chapter 4 has a summary of anticipated implications of the plan again set out in tabular form using the five themes identified above. This assessment summarises the findings of the SEA and AA.

3.8 Action Plan (provided in Chapter 6)

The Action Plan will be completed following the consideration of responses to the draft plan. These actions will be drawn together for the whole of the SMP2 coastline in Chapter 6.