

## PDZ9. ABERYSTWYTH:

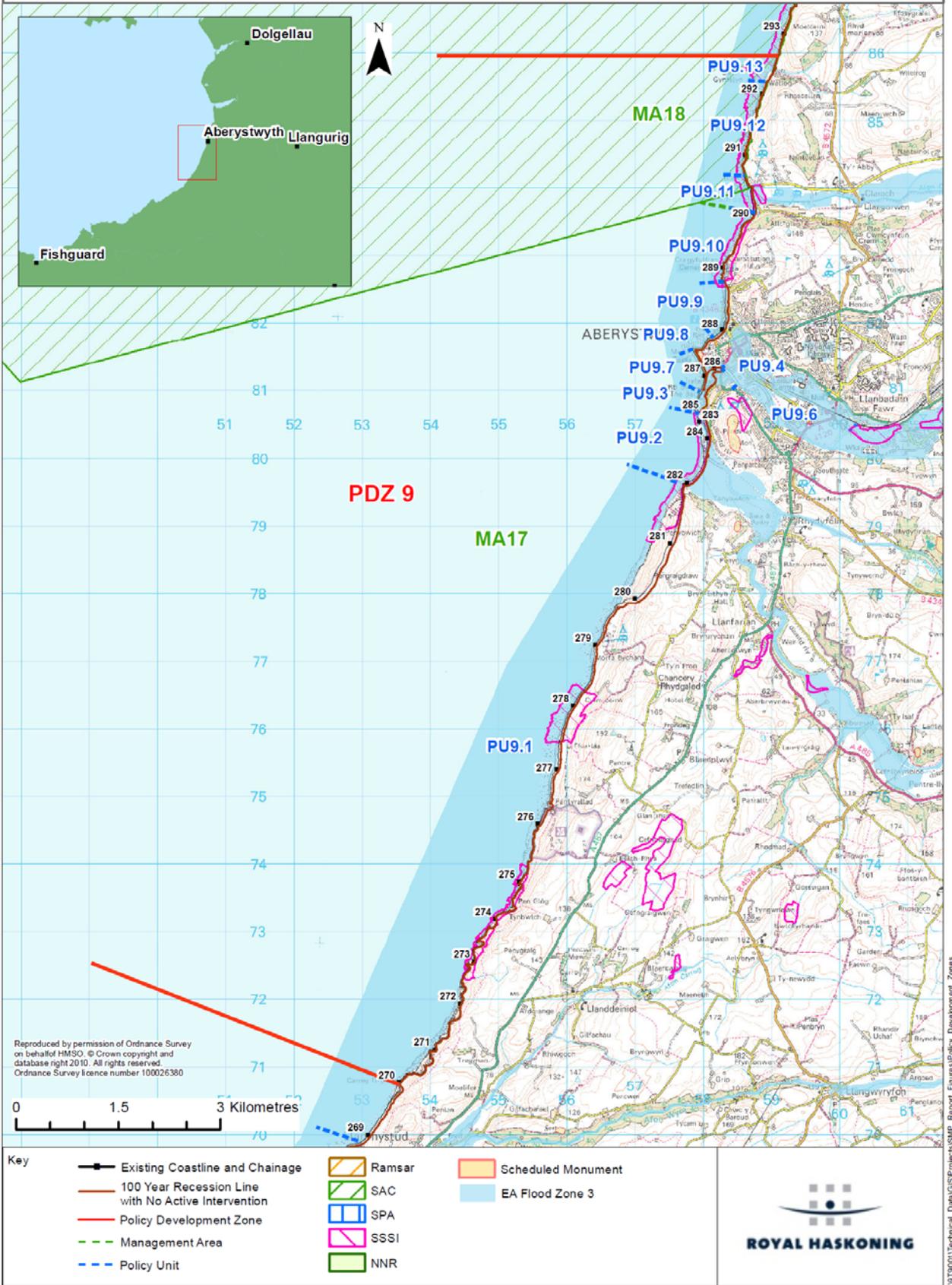


### Carreg Ti-pw to Sarn Gynfelyn

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**Shoreline Management Plan Sub Cell 9  
Baseline Location Map  
Policy Development Zone 9 - Aberystwyth**



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## Definitions of Scenarios Considered in Policy Development

This section defines the various scenarios that are used throughout the discussion of the Policy Development Zone.

### Sea Level Rise

It is recognised that there is a continuing uncertainty with respect to Sea Level Rise (SLR). Taking different SLR scenarios may affect the scale of impact or the timing of some changes, either in terms of sustainable management or in terms of impacts. In the discussion below of the baseline and alternative management scenarios, the Defra guidance on SLR has been generally been used. Where, in any specific area, the impact of SLR is felt to be significant and may change the context of management this discussion is held within a separate box, relevant to that section of text.

### Management scenarios;

#### *Unconstrained Scenario*

Under this scenario, the behaviour of the coast is considered as if there were no man made defences, effectively if they were suddenly not there. Although recognised to be a totally theoretical scenario it does provide a better understanding of how we are influencing the coastal behaviour and therefore the stresses and broader scale impact that are introduced. This assists in assessing first how the coast might wish to change, but also in defining the limits of interaction which the SMP should be considering.

#### *Baseline Scenarios*

- **No Active Intervention (NAI) – Scenario 1**, where there would be no further work to maintain or replace defences. At the end of their residual life, structures would fail. There would be no raising of defences to improve standards of protection.
- **With Present Management (WPM)– Scenario 2**. This scenario applies the policies set in the SMP1 or, where relevant, takes updated or clarified policies, if subsequent work has been undertaken e.g. studies or strategies. In many locations, the approach to management defined by SMP1 only covers a 50 year period. Where this is so, the intent of how the coast is being managed has been assumed to apply into the future. It should be noted that WPM does not necessarily imply a Hold The Line approach throughout the zone, in many areas present management may be for a No Active Intervention approach or one of Managed Realignment.

The aim of the No Active Intervention is to identify what is at risk if defences were not maintained. In a similar way, With Present Management aims to examine how the coast may develop, identifying where there are benefits in this management approach or where there may be issues arising in the future.

At the end of this sub-section a brief summary and comparison of the economic risk for each of the baseline scenarios is provided, based on the MDSF analysis undertaken during the SMP (including other study findings where relevant). The baseline scenarios are also assessed in terms of how they address the overall objectives for the Zone. This comparison between the baseline scenarios sets the scene for discussing possible alternative management scenarios which better address all the issues. This discussion is provided in the subsequent sub-section.

## 1 Local Description

This zone covers the coastline from Carreg Ti Pw, the cliffs to the north of Llanrhystud, to Sarn Gynfelyn, north of Wallog. The character of this PDZ varies greatly comprising the large coastal town of Aberystwyth in the centre of undeveloped principally high cliffed shoreline. The only other settlements are at Clarach and the few properties at Wallog. The predominate use of much of the coast is as pasture land behind the cliffs. It is therefore only at local points such as Aberystwyth that management of the shore is dominated by man made structures.



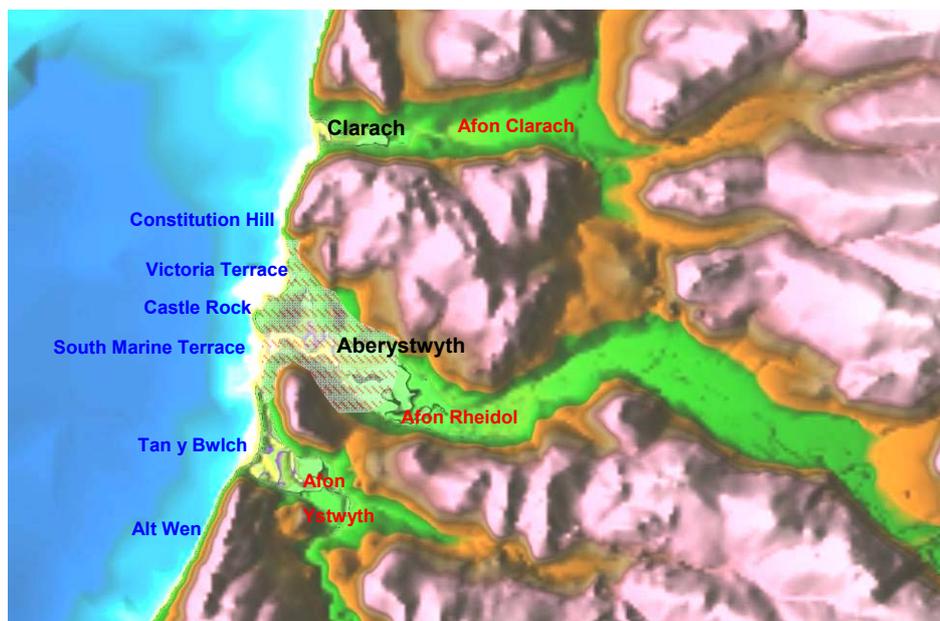
The coast may therefore be described in three principal sections.

### *Carreg Ti Pw to Alt Wen*

The coastline from Carreg Ti Pw through to Alt Wen is for the most part undeveloped and consists of 10km of high relatively hard rock cliffs. There is a large caravan park at Morfa Bychan within the centre of the area where a long shallow bay has formed backed by softer glacial clay cliffs. Several sections of the cliff and foreshore are designated as SSSI.

### *Aberystwyth*

The town of Aberystwyth is one of the largest settlements within the SMP extent.



This historic market and university town is important as the administrative, social and economic hub of West Wales. It has a strong tourism industry as well as being a commercial centre for the smaller communities in the region. The new Welsh Assembly

Government building, together with the local authority offices and offices of organisations such as the Forestry Commission and CCW are all located within the new development centre of the town.

The town is developed around the mouths of the two rivers: the Ystwyth, to the south, and the Rheidol. The main part of the town is developed within the valley of the Rheidol.



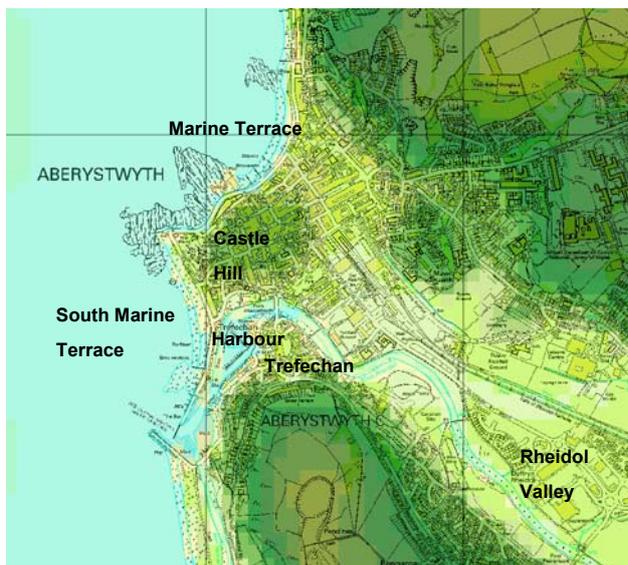
The Ystwyth valley is largely undeveloped agricultural land, with the river running north behind a large shingle bank, flowing into the harbour. This shingle bank is formed between the cliffs of Alt Wen and the harbour entrance structures. Within the valley the Ystwyth is confined in channel by low banks along its southern flank and in places by the old railway track to the north. At the head of the wide valley is the village of Rhydyfelin. This village is typically to higher ground, with a few

properties and a sewage pumping station at the edge of the river. The river comes very close to the back of the shingle bank in the centre of the Tan y Bwlch frontage and there are defences here to prevent a breach in the shingle bank.



Tan y Bwlch is held at its northern end by the Stone Pier, which forms the southern entrance to the harbour. The Pier also forms the southern extent of the second of the series of bays forming the Aberystwyth frontage. This central bay; South Marine Terrace, is fixed along its southern end by the defences to the harbour. At the northern end is Castle Hill and the outcropping Castle Rock and groyne. On the headland of Castle hill is the remains of the Aberystwyth Castle (SAM), a dominant and

important feature of the Aberystwyth sea front landscape.



Between the harbour area and Castle Hill there is row of property to the back of the South Marine Terrace promenade road and, behind this, the whole area of Castle Hill is developed as the older core of the town.

The harbour has been developed within the mouth of the Afon Rheidol. The main commercial quay is to the western side, developed on a defended ridge of land extending south from Castle Hill. The low lying area of Trefechan has been developed as the new marina, with older property filling the area back

to the Rheidol valley behind. The old main road from the south runs through Trefechan and crosses the bridge at the northern end of Trefechan.

The channel of the Rheidol was improved to run into the harbour area behind Castle Hill as the town developed. There is some suggestion that the old course of the Rheidol was to the north of Castle Hill, exiting to the coast at the present Marine Terrace. There are old maps which indicate marsh land between Castle Hill and the high ground to the west of the town and that the Rheidol was diverted to the south to help flush the harbour area. Certainly there is a low valley in this area, which has been developed as the older commercial centre of the town. The railway station sits within this valley and the northern side of the Rheidol valley has now been developed as the new commercial centre. The main road to the town now also runs through the valley, through the new development along the valley floor.

The Heol-y-Bont road crosses the Rheidol over a new bridge down to the central valley and now acts as the main route for through traffic between north and south of Aberystwyth. The railway line runs out of Aberystwyth along the northern side of the Rheidol valley. The central valley of the Rheidol now forms an essential area of infrastructure and development fundamental to the regeneration town.

The main tourist sea front to the town is north of Castle Rock, with Marine and Victoria



**Southern end of  
Marine Terrace**

Terraces. The promenade wall and road continues from South Marine terrace around Castle Hill, running to the back of the rock outcrop foreshore of Castle Rock. Behind the promenade are the old University buildings. To the northern end of Castle Rock is the Pier.



**Victoria Terrace, looking  
south to Marine Terrace**

The promenade reduces in level and widens, north of the Pier, to provide the main sea front. There are various properties, hotels and guest houses, together with sea side shops to the back of the promenade. A fine gravely shingle beach ramps up to the promenade. There is the timber landing stage and steep slipway at the southern end and the bandstand to the north. The bandstand is behind the a rock outcrop on the foreshore that forms the division between Marine Terrace and Victoria Terrace. Victoria Terrace is generally narrower than Marine Terrace and is built more forward on the natural

alignment of the bay so that, while there is still a shingle beach, the promenade wall behind is higher. There is an old tank beneath the northern section of the promenade. The promenade is backed by tall terraced properties typical of the Aberystwyth sea front. While behind Marine Terrace there is the main, old part of the town, Victoria

Terrace is backed by only one further row of property, land levels rising steeply in land. At the northern end of Victoria Terrace is the rising ground and cliffs of Constitution Hill.

The whole sea front an important aspect of the town, representing its Victorian built landscape as well as being identified as an important tourist attraction. A substantial part of the holiday accommodation is immediately behind the promenade and the promenade

### Aberystwyth Harbour



has recently been much improved and landscaped. The relatively recent development of the marina within the harbour has revitalised the area, with new property along the Trefechan frontage significantly regenerating the area. This, together with the active traditional commercial fishing quay provides a further essential feature of the town. There is also an RNLI station within the harbour and the main firestation in the area of Trefechan.

Tan y Bwlch and Constitution Hill are designated SSSI. Although not designated the castle rock houses important species.

### Clarach and Wallog

Clarach is a small village within the wide valley of the Afon Clarach. The main village is



Clarach

to the southern side of the bay, on and behind a relatively broad spit of land running across the entrance to the valley. The centre of the village is developed largely around tourism and there are two major holiday villages, to the north and south slopes of the valley. The main valley floor is agricultural pasture land. At the northern end is a small defended headland, in front of the main buildings of the northern caravan park. The river flows behind the broad spit and exits the bay at the northern

end. There is a broad shingle beach running down to a sandy intertidal foreshore. The Craigyfulfran & Clarach SSSI extends over the whole foreshore and entrance into the entrance of the valley. The Pen Llyn a`r and the cliffs and rock foreshore **Sarnau/ Llŷn Peninsula** and the Sarnau (SAC) starts at the northern end of the bay area and the cliffs and foreshore are designated as SSSI.

The Sarn Gynfelyn runs out from the coast at Wallog, just to the north of Clarach. There is one property at the shoreline at Wallog and the listed Lime Kiln and associated quay. The cliffs to either side of Wallog are relatively hard rock with the Wallog valet being lower lying glacial clays. The slight bay is infilled with a shingle foreshore behind the protection afforded by the Sarn.

## 2

### Coastal Processes

This stretch of the coast faces in a generally westerly direction in the centre of Cardigan Bay. The frontage is exposed to a broad spread of wave directions from the southwest through to the north. Sarn Gynfelyn, however contributes to sheltering the area from northerly swells.

The dynamics in this PDZ are fairly complex, influenced by the natural shape and controls of the shoreline and also by the man made structures and defences. To the south of the zone, from Carreg Ti Pw to Allt Wen, the coast is mainly fronted by rock, sand and mudstone cliffs, interrupted by sections of boulder clay. This frontage provides a small feed of sediment towards the north. The sediment supply is limited and is derived mainly from weathering and erosion of the cliffs principally from Allt Wen feeding the shoreline of Tan y Bwlch.

The southern section of Aberystwyth includes the beaches of Tan y Bwlch and South Marine Parade. The creation of the Harbour has had an influence in the shape of the coastline in this area, the main natural control being Castle Hill and Castle Rock.



The net sediment drift along Tan y Bwlch is in a northerly direction, although with the construction of the harbour pier the frontage has developed more as a swash aligned frontage. The gradual deepening curve of bay and roll back of the shoreline has threatened to result in a breach through to the channel of the Ystwyth. The Stone Pier acts to retain sediment within Tan y Bwlch restricting sediment movement through to South Marine Terrace. There is believed to be some sediment by pass of the harbour mouth but this tends to be the finer material (smaller gravel) that makes up the back beach of South Marine Terrace.



Monitoring has shown a very slow net loss of sediment along South Marine Terrace. Regular recharge of the beach, with dredgings from the harbour, only makes up part of this general loss. Sediment lost to the north of the bay, beyond Castle Rock does not return south. Despite the slow loss, the beach is seen from monitoring to be quite well orientated to net wave energy, but subject to both rapid draw down and period of more severe drift, depending on local wave conditions. It is recognised that the orientation of the main harbour defences tend to allow waves to scour along the walls driving material north. This local wave interaction also creates conditions for surfing. During conditions moving sediment north there can

be a build up of sediment at the northern end of the frontage. At the north end the sediment then spills around the groyne at Castle Rock, causing the net loss to the beach. Local conditions can result in loss of beach which then threatens to undermine the defences. The defence level along this frontage varies from typically 8m AOD in front of the Harbour to 9m AOD at Castle Hill. There is a lower point at around 7m AOD in the centre.

The Ystwyth, running into the harbour at the southern end, acts to help flush the harbour entrance. However, there is still a need for infrequent dredging in this area. More regular dredging is required, typically every two to three years, at the northern end of the harbour by the Gap. It is uncertain to what degree sediment is carried down the river into the harbour and to what degree sediment is carried into the harbour through the harbour entrance. A bar develops just offshore of the harbour, suggesting that there is mobile sediment at the entrance.

The northern frontage of Aberystwyth is formed across what has been reported to be the original position of the mouth of the Rheidol. Whether this was in reality just part of the marsh around Castle Hill and to what degree it was an actual river entrance is uncertain. It certainly seems as likely that there would have been a channel that was improved to the south of Castle Hill. There is evidence, however, that much of the area of the old town is constructed at least in part on made ground. As the sediment rich coast rolled back the form of the coast changed from being drift aligned to create the swash aligned bay between Castle Hill and Constitution Hill. The bay is now aligned well to the net wave direction; only along Victoria Terrace is the alignment of defences significantly out of alignment with the natural curve of the bay. As with South Marine Terrace, the beach along the whole of the northern frontage is very sensitive to the changes in wave direction. Beaches can be drawn down suddenly and there is evidence of differential drift along the length. However, as a result of the influence the large rocky headlands at either end, the bay is relatively stable and is only slowly suffering loss. The small rocky outcrop of The Weg, situated halfway along the bay, acts as an intertidal breakwater, allowing a higher beach level in the centre of the bay.



The frontage experiences overtopping and deposition of shingle on the promenade. The level of defence south of the Pier is around 9m AOD but, with only the exposed hard shoreline of Castle Rock, waves directly hit and overtop the promenade wall on a regular basis. The level of the promenade at Marine terrace is around 4m AOD and waves run up the shingle back slope to flood the promenade. At Victoria Terrace the defence level is around 6m AOD and

overtopping is again due to waves directly hitting the back wall. A rock toe has been placed against the wall to prevent undermining and to reduce beach draw down and overtopping.

With anticipated sea level rise, the shoreline over the whole area will attempt to retreat back. At Tan y Bwlch the natural behaviour would result in the shingle ridge rolling back some 40m to 60m. This would certainly breach through to the Ystwyth and in all likelihood a new entrance would form. This would form a new local control feature along the beach tending hold the general shape of the bay. Along the other frontages, increased exposure would tend to result in increased drift and significant draw down of the beach.

North of Aberystwyth, Clarach Bay is relatively stable, but with higher water levels and storms eroding the clay backshore.

**Clarach**



There is some sediment supply from the cliffs to the south and the beach is well held by the higher harder foreshore to the north. The steam forms a good sediment fan over the beach area, again demonstrating the general low drift along the frontage but also acting to sustain the position of the shoreline.

With sea level rise, the natural shingle defence will attempt to roll back and the clay bank will be more regularly overtopped and eroded.

The shingle beach at Wallog is relatively in equilibrium but subject to sudden draw down under different wave conditions. The alignment of the old Lime Kiln quay is slightly out of line with the shore and exacerbates the drawdown of the beach. With sea level rise, the Sarn, which provides much of the stability to the shore, will be more submerged. This is likely to give rise to greater drift and erosion.

**POTENTIAL BASELINE EROSION RATES**

In assessing erosion and recession in the future allowance has been made for Sea Level Rise and this is discussed in Appendix C. Due to the long history of defence in the Aberystwyth area, there is no information to base erosion rates on. Monitoring only provides information from the last 10 years. Much of this PDZ is either composed of undeveloped harder rock cliffs, or where the land is developed they are heavily defended, much of the erosion tends to occur locally in some of the smaller bays.

Location	NAI Base Rate (m/yr)	Notes	100yr. Erosion range (m)
Carreg Ti-pw to Alt Wen	0.4	Eroding cliffs with areas of slippage.	10 - 50
Tan y Bwlch	0.4	Slowly eroding shingle ridge, sensitive to sea level rise	20 - 40
Aberystwyth	0.3	Heavily defended frontage.	10 - 70
Clarach	0.2	Slowly eroding shingle ridge, sensitive to sea level rise	15 - 60
Wallog Cliffs	0.4	Eroding cliffs with areas of slippage	10 - 40

Base rates have been assessed from monitoring and historical data. The range of potential erosion is assessed in terms of variation from the base rate and sensitivity in potential sea level rise. Further detail on erosion rates together with erosion maps are provided in Appendix C.

## FLOODING

The flood risk is as significant as the erosion risk, particularly at Aberystwyth and Clarach and especially with sea level rise.

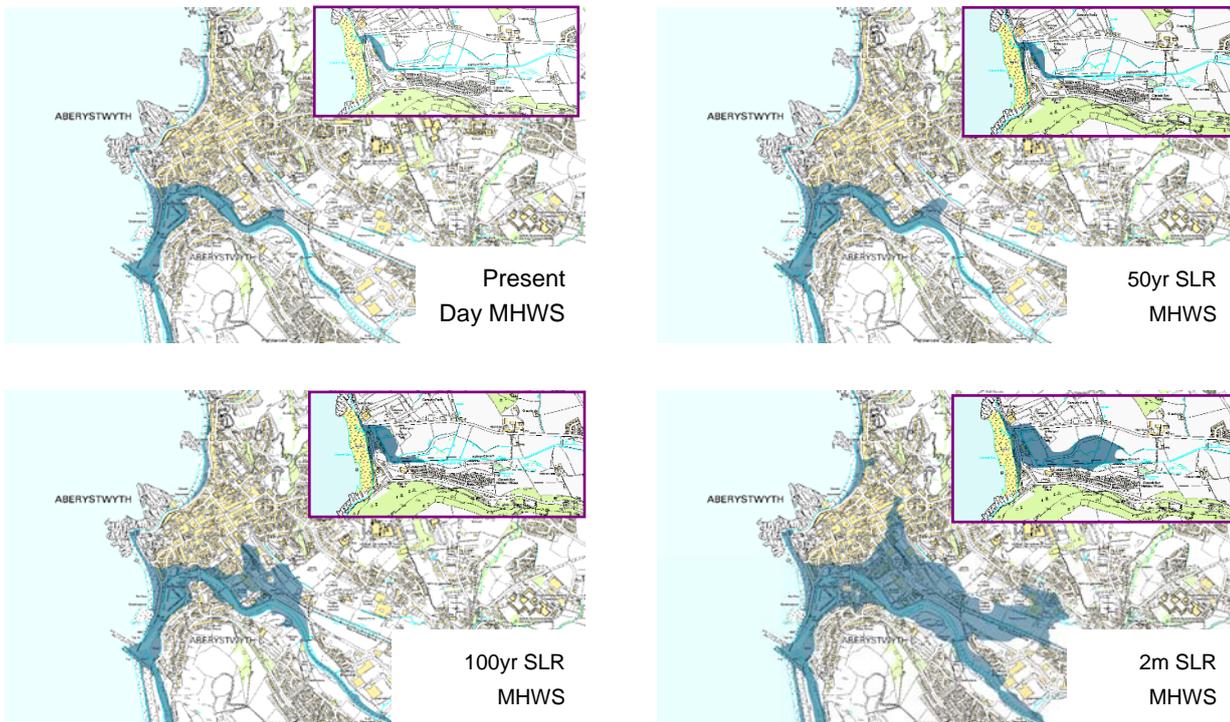
To the south of the PDZ, the high cliffs are subject to erosion under higher sea levels, however there is little at risk here and little risk of flooding.

At Tan y Bwlch, there is present risk of normal tidal flooding to local areas of the valley. The marshy area to the southern fields is evidence of this. Although a much larger area of the valley floor is at risk on more extreme events, there is little flood risk further up the valley. With sea level rise much of the lower area behind the shingle ridge would be below MHWS.

### Impact of different Sea Level Rise Scenarios

With higher Sea Level Rise of 2m over the next 100 years the areas of the lower valley subject to normal flood risk would take up about half of the lower valley floor. It is only under more extreme events that, under this scenario, would there be flooding affecting low lying property at Rhydfelin.

The main risk at present is to the harbour and the Rheidol valley at Aberystwyth, with much of the central valley, including the railway station being below the 1:10 year flood level. Local areas of Trefechan are at similar risk. These areas are defended. The potential flood risk areas, below MHWS, under different sea level rise scenarios are shown in the plot below.



Under the 50 years sea level rise (0.36m) the MHWS flood risk would extend across the developed central valley area. With 1m sea level rise the area increases towards the railway station for MHWS, with the 1:10 year extreme level extending through to the centre of the town. Under these conditions there could also be flooding from Marine Terrace through to Queens Road, but not linking through to the flood risk area of the Rheidol valley. At Trefechan it is only under the 1:10 year event that Trefechan is at risk.

The CFMP identifies many of these areas at risk from fluvial flooding under extreme events, even at present. It is, therefore, the change from extreme event flood risk to that where areas might be below normal tide levels in the future that gives the significant difference. The defended areas would then be more difficult to drain by gravity sluicing.

#### Impact of different Sea Level Rise Scenarios

With higher Sea Level Rise of 2m over the next 100 years much of the central valley would lie below MHWS, extending over an area equivalent to the present 1:1000 year flood zone. Much of Trefechan would be below MHWS. It is only on more extreme tidal water levels, under this sea level rise scenario that there is risk of the flood area from Marine Terrace joining with the flood risk area within the Rheidol valley. Under a 1:10 year extreme water level the whole of the valley floor is at risk.

On the open coast, the risk of flooding due to wave overtopping would substantially increase. There is already regular wave overtopping of much of the sea front area on severe storms. This would obviously increase with sea level rise. The recent Aberystwyth Coastal strategy identified this risk reporting several events during 2000 and 2001. In developing the strategy, a sea level rise of 0.5m was considered. This would be equivalent to sea rise in 65 years time based on the 1m scenario and occurring in 45 years under the 2m scenario. Therefore, within about 50 years severe overtopping would be a regular occurrence with increased risk of flooding.

The different sea level rise scenarios for Clarach are shown as insets in the plot above. At present the flood risk under normal tides is quite limited to the area immediately behind the ridge of land. It is really this area that suffers under different sea level rise scenarios. The steeper sides of the valley, beyond the flat valley floor, remain only at risk of flood on more extreme events. The extent of flooding on MHWS spreads up the valley.

#### EXISTING DEFENCES

Only within the Aberystwyth and Clarach area are there substantial defences.

There is a significant section of defence in the centre of Tan y Bwlch where the Ystwyth runs close to the shingle bank, where it is at risk of breaching. There are also small sections of rock placement at the southern end of the bay. The Old Stone pier provides a defence to the Harbour and is also reinforced with a cribwork rock structure at the southern end.

South Marine Terrace is a long shingle beach, with a promenade situated behind a sea wall that stretches the length of this bay. The levels of the beach are lower at the southern end and higher along the north towards the Old Stone Pier. The beach is backed by continuous masonry and concrete walls, with concrete groynes to the south of the beach and the one to the north retaining the important beach in the area.

The Stone Pier, constructed in the 19<sup>th</sup> century, is situated on a section of hard raised sea bed. This pier was constructed as the entrance to the harbour, anchoring the coast where the Ystwyth meets the Rheidol. The harbour itself is predominantly man made and hard defences run the length of the harbour in the form of masonry walls. The new marina raises defences to Trefechan and there are defences to the back along Glanyrafon Terrace.

The developed northern side of the Rheidol valley is defended by large embankments, although close to the bridge the defence is provided by a vertical river wall.

Between South Marine Terrace and the northern beach, lies the hard rocky platform of Castle Rocks, upon which sits a sea wall that runs around the headland past the pier, towards Marine Terrace. This large masonry wall also has semi circular access bastions protruding from the line of the wall.

The Victorian and Georgian promenade of Victoria and Marine Terrace is defended with a large sea wall along the frontage. A series of concrete and timber groynes are present towards the northern section of Victoria Terrace.

At Clarach there are various private defences to the southern end and the earth bank is protected by timber breastwork which is in poor condition. There is a short length of defence to the slight headland at the northern end of the Bay.

The only defence at Wallog is that of the old Quay. This prevents erosion to the bank beneath the house and is privately maintained.

#### **UNCONSTRAINED SCENARIO**

At Tan y Bwlch in the absence of the defence and rock armour the ridge would breach and in all probability the Ystwyth would flow out in the centre of the bay.

In the absence of the Stone Pier sediment would not be retained to the south. However the flow of the river at the harbour entrance would result in some constraint to shoreline drift. There would be greater supply to the north.

The coastline of Aberystwyth in particular has been heavily modified to allow for the harbour and subsequently the development of the town. It now relies on its defences. Under an unconstrained scenario there would be significant erosion along the whole frontage, tending to allow the coast to set back sufficiently to retain more stable beaches.

Clarach Bay and Wallog would look much the same, however, without the development currently in place, the shoreline would be likely to be situated further inland, and the bays a little deeper.

#### **KEY INTERACTION WITH DEFENCES**

The defence to Tan y Bwlch is beginning to have a significant impact of the shingle ridge, creating a far more vulnerable ridge.

The presence of the Old Stone Pier retains sediment to the northern end of Tan y Bwlch. It also controls the mouth of the harbour and both restricts sediment movement to South Marine Terrace but also provides important protection to the area. The defences to the seaward face of the harbour results in waves scouring the beach but encourages sediment to build at South Marine Terrace. The promenade wall restricts the width for a fully stable beach to form and the north groyne at Castle Rock holds the beach in place.

Along the northern frontage of Aberystwyth, the main impact of the defence is in stopping erosion which would result in providing width for a more stable beach to form. The northern end of Victoria Terrace extends slightly forward helping to retain the beach to the south.

### 3 Management Scenarios

#### 3.1 No Active Intervention – Baseline Scenario 1.

The undefended, natural sections of coastline will continue to erode in the way in which they already are, with slow cliff erosion of the harder rocky cliffs.

At Tan y Bwlch, if the defences were not maintained, it is likely that gradual roll back would lead to a weakening of the defence and a breach in the shingle bank. The Ystwyth would flow out in the centre of the bay. This would lead to regular flooding of the hinterland as the embankments fall into disrepair. This is likely to create saltmarsh over the new estuary that would form. As a consequence of this breach, the shingle bank either side would tend to migrate in land rapidly closing off the Ystwyth route to the harbour. This would change the dynamics within the harbour as there would be less flushing by the river. However; it would allow for new habitat to develop and would allow the coast to behave in line with the natural processes. It would not significantly impact on the drift to the north as the current northerly drift is limited by the Old Stone Pier. The Pier may remain as a significant control on the coast in to epoch 3. However, without maintenance, the Pier would fail as a navigation structure and the entrance to the harbour would be lost, possibly over epoch 2.

A no active intervention scenario within the harbour would incur very significant flood risk to the harbour and to areas of Trefechan, potentially during epoch 2. Progressive deterioration of the defences to the northern side of the Rheidol Valley would result in their failure. This deterioration would rapidly increase as, with sea level rise the current 1:100 year defence level would reduce to that of about 1:10 standard towards the end of epoch 3. It is likely that defences might fail during epoch 2. This would open the whole valley to the flood risk described earlier. During epoch 2, use of the area would be untenable. The main road into the town would be unusable for much of the time. The railway station would become redundant as the railway line would be subject to regular flooding. Flooding would extend to the older centre of the town.

Along South Marine Terrace, defence might fail within epoch 1 with erosion resulting in the loss of the promenade. This failure would be hastened by the failure of the groyne at the northern end.

This scenario is also true of the north of the Castle Rocks area, to the south of Marine and Victoria Terrace. Failure to maintain the existing defences would eventually lead to a collapse in defences and a loss of the road, promenade and the university buildings. The character of Marine and Victoria terrace relies heavily on its defences. The properties, the road and the promenade are all situated on top of the sea wall. The frontage is currently experiencing issues with the defences, ie exposure of the toes of the sea walls in some places and overtopping in others, leading to shingle being deposited on the road. As the beach profile lowers, this overtopping is likely to increase. As the land behind the promenade is lower than that along the promenade, the town would not only suffer substantial erosion but also a great risk of regular flooding with sea level rise. The entire character, infrastructure and assets along the frontage would be lost, potentially within epoch 2.

At Clarach, the defences are situated along the crest of the currently eroding beach. The greatest erosion occurs at the centre of the beach. The concrete and timber defences would eventually fail and allow continued erosion. The greatest risk would be the loss of the sea front facilities. There would be loss of some property at the northern end of the frontage, affecting the northern caravan park. There would be significantly greater

flooding of the valley floor with sea level rise but this would only affect local areas of the two main caravan parks.

At Wallog, the quay wall would fail and potentially slow erosion of the bank behind would result in loss of the property sometime in epoch 2. There would also be loss of the Lime Kiln and the coastal path.

### 3.2 With Present Management – Baseline Scenario 2.

The following table sets out current policy and management approach for the Zone.

SMP 1			Subsequent Management Approach
No.	Management Unit	Policy	
<b>Ceredigion SMP1</b>			
12.1	Allt Wen Cliffs	DN	
13.1	Tan y Bwlch	HTL	Aberystwyth strategy HTL
13.2	Aberystwyth Harbour	HTL	Aberystwyth strategy HTL
13.3	South Marine Ter.	HTL	Aberystwyth strategy HTL
14.1	Aberystwyth Castle	HTL	Aberystwyth strategy HTL
14.2	Marine/ Victoria Ter.	HTL	Aberystwyth strategy HTL
15.1	Clarach Cliffs	DN	
15.2	Clarach	R	
15.3	Wallog	DN	

**Key:** DN – do nothing, HTL – Hold The Line, SHTL – Selectively Hold The Line, R – Retreat, deferred – policy deferred subject to further monitoring or study.

The Aberystwyth Coastal Strategy 2006, makes specific reference to the approach to be taken in each area

#### *Tan y Bwlch*

*Construction of a rock armoured revetment along part of the frontage to stabilise defence along with a system of groynes to retain material on the foreshore<sup>1</sup>. It is noted, however in the strategy that there is no economic justification for this approach to management.*

#### *The Harbour:*

*The harbour structures would be maintained and the levels of flood walls increased in response to increased sea level rise. Dredging operations would continue.*

#### *South Marine Terrace*

*Floodwalls would be constructed to the rear of the promenade to prevent flooding of properties from water overtopping the defences.*

<sup>1</sup> *At Tan y Bwlch the SMP1 policy was to hold the line but potentially do nothing in the longer term. Holding onto the shingle ridge and preventing a breach would maintain the use of the harbour. In the longer term, beyond 50 years, SMP1 stated the longer term policy to potentially be to do nothing. If this occurred, the defences would ultimately breach and change the course of the Ystwyth, having consequences on the harbour. This would also create new habitat and allow for a northern migration of sediment, past the stone pier. In the longer term it would become difficult to hold the line at Tan y Bwlch as sea levels rise and the shingle bank rolls back towards the river.*

*Victoria Terrace*

*This option involves refurbishment of the existing defences along the frontage. The masonry seawall would be repaired and the groyne system replaced. The rock revetment at Victoria Terrace would be reprofiled. Floodwalls would be constructed along the rear of the promenade to mitigate flooding from overtopping water. In addition the existing groyne field located along Victoria Terrace would be replaced.*

It should be noted that the strategy was based of sea level rise guidance that indicted 0.5m SLR over the next 100 years.

The following information and policy is abstracted from the Pembrokeshire and Ceredigion Rivers CFMP Draft Plan

**Preferred policies for Policy Unit 1 – Northern Coastal Rivers**

<p><b>Policy Unit 1 Northern Coastal Rivers</b></p>	<p>The Northern Coastal Rivers policy unit comprises of the watercourses draining the Pembrokeshire and Ceredigion coast from Fishguard to south of Borth.</p>
<p><b>Problem / risk:</b></p>	<p><b>Problem:</b> There are several main rivers in this policy unit, including the Afon Rheidol, Afon Clarach, Afon Ystwyth and Afon Aeron. The main sources of flooding in this policy unit are from the main rivers and from tidally influenced river flooding. Surface water and sewer flooding area also experienced in this policy unit, particularly in the main urban areas.</p> <p><b>Current flood risk:</b></p> <ul style="list-style-type: none"> <li>- The majority of the flood risk is concentrated in Aberystwyth, Aberaeron, Clarach, Bow Street, Penrhyn-coch and Llanrhystud. 71% of the people at risk in the whole policy unit are located in these main flood risk areas.</li> </ul> <p><b>Future flood risk:</b></p> <ul style="list-style-type: none"> <li>- The flood risk across the whole policy unit is not expected to increase significantly as a result of climate change, landuse change or urbanisation.</li> <li>- The majority of the increased number of people at risk in the future are located in the main flood risk areas of Aberystwyth and Aberaeron, where the current flood defences are unlikely to provide adequate protection from a 1% AEP flood event or higher in the future.</li> <li>- During a 1% AEP flood event the population at risk of flooding is expected to increase by approximately 178% and the residential and commercial properties at risk are expected to increase by approximately 108%.</li> <li>- 78% of the increased flood damages are estimated in Aberystwyth and Aberaeron.</li> <li>- The flood risk in the main flood risk areas of Aberystwyth and Aberaeron is expected to increase, as the current flood defences are unlikely to provide adequate protection in the future.</li> <li>- It is likely that flood depths will increase in the future, with typical depths of flooding during a 1% increasing by nearly 1m as a result of sea level rise in Aberystwyth and Aberaeron.</li> </ul>
<p><b>Policy selected</b></p>	<p>Policy 3 – Continue with existing or alternative actions to manage flood risk at the current level</p>
<p><b>Justification and alternative policies considered</b></p>	<p>Policy 3 - A policy option 3 would allow the flood risk management measures to be reviewed and reprioritised in order to address flood risk as it increases in the future. In the absence of new or heightened flood defences, flood warning could be prioritised and stepped up, and policy could be used to divert further development away from flood risk areas. This would benefit Aberystwyth and Aberaeron in particular. A policy 3 is appropriate for this policy unit because the level of flood risk across the policy unit as a whole is currently assessed as low and is not expected to increase significantly in the future. The majority of the</p>

	<p>increased flood risk (approximately 78%) is concentrated in Aberystwyth and Aberaeron, where the flood risk issues can be resolved through localised measures or a change in emphasis in the current levels of flood risk management activities across the remainder of the policy unit. Under a Policy 3 annual average damages are expected to increase by approximately 0.82m to £1.56m.</p> <p>We have selected this policy based on the risk posed by inland flooding sources and tidal flooding sources. If the risks posed by tidal flooding were removed from the policy appraisal process, preliminary estimates suggest that this policy would remain a P3.</p>
<p><b>Catchment-wide opportunities &amp; constraints</b></p>	<p><b>Opportunities:</b></p> <p>To reduce future flood risk by influencing and informing the planning process for new developments planned for Aberystwyth and Aberaeron and other smaller settlements in this policy unit, to prevent vulnerable land use from being located in the floodplain and through the appropriate use of SuDS.</p> <p>To reduce surface water run-off and sediment loss in the upper catchments of the Afon Rheidol, Afon Ystwyth, Afon Aeron and Afon Clarach, and improve water storage in the lower catchments through applying environmental and land management initiatives, such as Tir Cynnal, Tir Gofal and Catchment Sensitive Farming to the dairy farming activities in this policy unit.</p> <p>To reduce run-off from the upper catchments should be investigated through working with the Forestry Commission Wales and their Better Woodlands for Wales project.</p> <p>To reduce flood risk to Aberystwyth and Aberaeron through improved flood warning and emergency response.</p> <p><b>Constraints:</b></p> <p>Flood risk management objectives should compliment the Central Cardigan Bay SMP although it should also be noted that where appropriate, the CFMP may need to influence the SMP.</p> <p>Steep coastal catchments with potential for rapid response to flooding such as the Afon Rheidol, Afon Ystwyth, Afon Clarach and Afon Aeron in the Northern Coastal Rivers policy unit, can provide difficulties for certain flood risk management activities. We must recognise this, and accept that there is little we can do to change the frequency or extent of flooding. Our approach to managing flood risk therefore must focus on reducing the impact.</p>

The SMP1 policies define the importance of defending the Aberystwyth area. This is taken forward in the strategy with the clear intent to raise defences in response to sea level rise.

The Catchment Flood Management Plan (CFMP) for this region examines principally the fluvial flood risks. The CFMP for the Northern Coastal Rivers region, includes the Afon Aeron, Afon Ystwyth, Afon Rheidol and Afon Clarach. This plan identifies the main areas at flood risk, in the future as well as present flood risk to Aberystwyth. The preferred policy option is Policy 3; *“Continue with existing or alternative flood actions to manage flood risk at the current level”*. The CFMP discusses how flood resilience, preparedness and awareness are vital in managing the flood risk to these towns. Rather than simply

raising defences to cope with higher water levels in the future, the CFMP recommends that the policy is used to divert further development away from the areas at risk.

There is, therefore, a degree of difference between the policy intent set out in the SMP1, and subsequently taken forward by the coastal strategy and that set out by the CFMP. The SMP1 refers principally to the open coast, while the CFMP refers principally to the area of the Rheidol valley. These then define the With Present Management scenario considered below.

Over the southern section of the coast through to the Allt Wen, the policy is for No Active Intervention, this is the same as scenario 1. In taking this approach the natural function of the coast is sustained. This maintains the existing nature conservation values, as well as maintaining a sediment supply to the north. There will be some gradual loss of land generally at the cliff crest and in particular erosion at Morfa Bychan over the 100 years. At present there are some groynes helping to hold the beach at Morfa Bychan. These would fail but the subsequent erosion would not be large. This policy seems appropriate to the scale of risk.

The policy and approach at Tan y Bwlch is optimistic. At present the short section of defence comes under pressure on occasions. Under this scenario, as this pressure grows, so further work would be undertaken to defend against overtopping and breach. Gradually at first, there would be a need to reinforce the toe of the sea wall and to further reinforce and raise other sections of defence. This in its self would be difficult to justify economically as has been shown in the strategy. With sea level rise, the need for defence would increase. The rock revetment would be extended, with an intent to extend this further. Associated with this would be the need to raise the embankments along the length of the river. Even then, drainage would become an issue. To sustain the current use and nature of the pasture land would involve pumped drainage, as the time available to drain under gravity would decrease. The approach is seen as being unsustainable.

The works along the main frontage would also result in a reduction of drift to the north and the works to protect the root of the Stone Pier would have to be increased. Both here and along the main frontage there would be increased vulnerability to sudden failure.

Within the harbour area and at Trefechan the approach under this scenario would be to continue to defend and to raise defences in line with sea level rise. Along the commercial quay there would be the need to maintain the walls and some action would be required to raise the operational area with sea level rise. This is seen as sustainable over the 100 years with 1m sea level rise.

#### Impact of different Sea Level Rise Scenarios

With higher Sea Level Rise of 2m over the next 100 years, the operational area of the harbour would need substantial modification to allow continued use of the quay. In principle this is not unrealistic, but there would be the need to plan this change over time.

As sea levels rises, the defence to Trefechan would need to be raised. This frontage already offers significantly better defence than historically. There is the opportunity to increase defences without significant impact on the area behind. The real problem arises in the apparent difference in approach between the SMP1 intent and that of the CFMP to the back face of Trefechan, at Glanyrafon Terrace. Under the SMP1 and

coastal strategy approach, the river wall would need to be raised. This would over the full period of the SMP2 mean that there would be a high wall in front of properties along the terrace, the long term intent to continue to raise the wall. This would become technically difficult in the space, requiring a major structure to resist hydraulic loading. Drainage of the local area, prone already to surface water flooding, would become a major issue. Under the change in emphasis suggested by the CFMP, the approach would be to provide greater resilience and to control risk through planning control. The concept of sustainable drainage would not be effective due to raised ground water. Rather than purely adapting property to deal with the increased risk it seems more realistic to expect property to be vacated. This would not fully address the long term problems in maintaining the important access across the Bridge.

#### Impact of different Sea Level Rise Scenarios

With higher Sea Level Rise of 2m over the next 100 years, the issues at Glanyrafon Terrace become more severe. Defences would need to be raised potentially some 2m over the period of the SMP. The defence to the back of Trefechan would become increasingly reliant on this back defence. It is uncertain to what degree the bridge itself would be at risk and this would need further investigation.

Overall neither approach is seen as fully sustainable.

Within the main valley of the Rheidol, the approach put forward by the CFMP is seen as sustainable over the first two epochs. The real risk occurs in epoch 3, as the embankments are subject to increasing risk of overtopping due to sea level rise. Significant effort would have to go in to reinforcing the banks to allow overtopping without failure. This increased risk of flooding would affect the land use in particular to the older area of development around the town. Without raising defences, the railway station and railway line would be at significant risk, with little opportunity to mitigate risk through planning or sustainable drainage. Similarly, such an approach to managing risk would be seen as being unsustainable in terms of the function of the centre of the town.

#### Impact of different Sea Level Rise Scenarios

With higher Sea Level Rise of 2m over the next 100 years, a large section of the Rheidol valley floor would be below MHWS. This area would extend into the centre of the town. The present physical level of defences if maintained at that level might only provide a 1:1 year standard of defence. The defences would be difficult to maintain with that level of overtopping and would in any event provide such limited protection as to be worthless. Under this scenario, where the emphasis is on risk management rather than increasing the physical level of defence, the approach would be through planning to move property away from the central valley of the Rheidol.

The scenario outlined above is recognised to be an extreme extension of the intent set out in the CFMP. In reality there is likely to be the need to raise defences, and there is generally the width along the river bank to allow this to occur. It does, however, highlight the significant change in conditions that could be faced in the future, with greater and greater reliance on defence in sustaining the essential core development; both past and more recent.

Along the sea front, the strategy conclusion was generally for reinforcing and raising defences. This was based on the probable sea level rise of 0.5m over the 100 year period. The strategy did consider an offshore breakwater but concluded that, economically this could not be justified in comparison with maintaining the linear approach to defence. Given the more recent estimates of sea level rise, the strategy

was considering conditions that might now occur within 45 to 65 years time. This scenario considers the implications of extending the approach taken by the strategy forward over the 100 years, with the revised estimates of sea level rise.

The approach is seen as being sustainable over the next 50 years. As sea level rise continues over the 100 years, the approach would be to continue to raise defences, typically in the form of set back crest walls along the frontage to address overtopping and increased use of rock revetments along the front face. Technically this would be seen as being sustainable over the period of the SMP. However, there is likely to be significant reduction of beach level and width. The general appearance of the frontage has been assessed in the strategy in term of the visual appearance overall and this was felt not to be out of keeping with the relatively hard defended appearance at present. However, from an amenity and local appearance there would be substantial impact. The need to raise walls would work to separate the town from the sea front and there would be little beach width and this would detract from use of the area. The defence, particularly in front of Victoria Terrace, around Castle Hill and at South Marine Terrace would, obscure the existing masonry sea walls, which are very much part of the landscape.

Therefore, while seen as being technically sustainable, and while recognising the important value in continuing to provide defence to the town, the approach outlined in the strategy could over the 100 years result in unacceptable loss of the important landscape and function of the sea front.

At Clarach, the SMP1 policy is to retreat the line. This is suggested to involve retreating the central part of the bay, increasing the width of the beach, which may in time create a more natural form of defence. 'Opening up' the centre of Clarach would reduce the land area and increase the flooding inland; however this would be manageable in allowing some local defence to either side of the valley to manage extreme flood risk. Attempting to defend the central frontage would not address the flood risk behind and would result in loss of the beach. At the northern end defence of the small car park and property in this area might be feasible over epoch 1, but would require significantly greater effort in the future. This could also impact on the internationally designated area. Long term defence of the frontage is not seen as being sustainable without loss of the important amenity and nature conservation values. The approach is seen very much one of adaptation with the concept of retreating defences.

The WPM scenario for Wallog is No Active Intervention. This is likely to result in loss of the significant historic assets and in the longer term the loss of the property. Holding the line indefinitely is, however not seen as being sustainable, with the increased exposure, resulting largely from the reducing influence of the Sarn as sea level rises.

#### 4 Summary Comparison and Assessment of Baseline scenarios.

Table 1 compares the economic damages that might arise under the two baseline scenarios. Table 2 provides a summary comparison in terms of the overall objectives based on the key issues identified in the introduction to this Coastal Area.

Erosion damages and those associated with flooding are identified separately in Table 1. The aim of this table is to demonstrate the potential economic damage that might arise from either flooding or erosion. As such properties that might be lost in the future due to erosion are not discounted from the assessment of flooding. Similarly, properties whose value may have been written off due to regular flood damage are still included within the assessment of erosion. Such an approach is clearly not strictly in line with normal economic appraisal at strategy or scheme level. It is however, considered appropriate at the higher level of the SMP assessment where the essential aim is in identifying potential different forms of risk in assessing different scenarios. Where this is felt to disproportionately distort the economic assessment then this is identified in appendix H and the economic case adjusted accordingly.

The assessment of economic damage is made using a simplified Modelling Decision Support Framework (MDSF). In the case of erosion, this GIS based tool takes the predicted erosion distance for any section of the coast based on the assessment of erosion by the end of each epoch. It is then taken that there would be a linear erosion rate between these timelines (e.g. a property located midway between the epoch 1 timeline (20 years) and that for epoch 2 (50 years) would be taken as being lost in 35 years). Each property is defined by a single point rather than by its full footprint. No account is taken in the assessment of loss of access or loss of services, although this is discussed in the text where critical. The MDSF method then draws information from a property data base, providing general information with respect to that property. The value of the property is discounted in terms of when that property may be lost.

In the case of flooding, the open coast water levels are assessed against threshold levels for individual properties based again on the property point source data base. No detailed modelling has been undertaken to assess flow paths and or possible increase in water levels due to estuary processes. It is taken that, when a flood defence fails or is overtopped, the whole flood area behind a defence is open to flooding and that flooding would occur to the full extent of the potential flood plain, over a single high water period. Damages are assessed in relation to the depth of flooding that would occur based on the type of property identified in the data base. From this assessment of potential flood damage for any specific water level condition, annual average flood damages are determined during each epoch. An average annual average damage value is taken between the present (2010) and 50 years time (2060) and between 2060 and 2110. This average value is taken in determining an estimate of discounted Present Value (PV) Damages over the period of the SMP. This simplified approach allows consideration of flood risk under different sea level rise predictions for different scenarios.

**Table 1. Economic Assessment**

The following table provides a brief summary of erosion damages determined by the SMP2 MDSF analysis for the whole PDZ. Further details are provided in Appendix H. Where further, more detailed information is provided by studies, this is highlighted. The table aims to provide an initial high level assessment of potential damages occurring under the two baseline scenarios.

**ASSESSMENT OF EROSION DAMAGES**

Epoch	0 -20 year		20 – 50 years			50 – 100 years		50 – 100 years (2m SLR)		PV Damages (£x1000)		
	No. of properties:		Value x £k	No. of properties:		Value x £k	No. of properties:		Value x £k		No. of properties	
Location	Res.	Com.		Res.	Com.		Res.	Com.		Res.	Com.	Res.
Aberystwyth Harbour	0	0	0	0	0	0	0	3	54	0	3	10
Aberystwyth South Marine Tr.	0	0	0	0	0	0	15	5	1,900	21	10	183
Aberystwyth Victoria and Marine Tr.	0	0	0	0	0	0	143	16	17,879	202	34	2,285
Clarach	0	0	0	0	0	0	0	3	163	1	3	67
<b>Total for PDZ1</b>												
With Present Management	No. of properties		Value x £k	No. of properties		Value x £k	No. of properties		Value x £k	No. of properties		PV Damages (£x1000)
	Res.	Com.		Res.	Com.		Res.	Com.		Res.	Com.	
Aberystwyth Harbour	0	0	0	0	0	0	0	0	0	0	0	0
Aberystwyth South Marine Tr.	0	0	0	0	0	0	0	0	0	0	0	0
Aberystwyth Victoria and Marine Tr.	0	0	0	0	0	0	2	0	263	2	0	24
Clarach	0	0	0	0	0	0	0	3	163	1	3	65
<b>Total for PDZ1</b>												
Notes: PVD determined for 1m SLR in 100 yrs.												
Other information: Damages are sensitive to time of loss and the above assessment does not take account of loss of services. The recent strategy identified NAI damages for flood and erosion over 50 years as: Harbour - £7M, South Marine terrace - £3.2M, Marine and Victoria Terrace – £7.6M. This includes revenue loss within the harbour.												

The following flood damages have been determined through use of MDSF. These figures are aimed to indicate the level and impact of flood risk rather than being a detailed economic appraisal. In many areas substantial numbers of properties would be liable to flooding on the more frequent events both under NAI and WPM, a nominal write off value has been allowed in the table for properties at frequent risk; this generally excludes values at risk at present on a 1:1 year event, in 50 years time for the 1:10 year event and in 100 year time the 1:50 year event.

#### ASSESSMENT OF POTENTIAL FLOOD RISK

No Active Intervention	Flood risk tidal 2010			Flood risk tidal 2060			Flood risk tidal 2110			tidal risk 2m SLR		PVD (£x1000)
	No. of properties		AAD x £k	No. of properties		AAD x £k	No. of properties		AAD x £k	No. of properties		
	<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr	
<i>Location</i>	<1:10 yr.	>1:10 yr	x £k	<1:10 yr.	>1:10 yr	x £k	<1:10 yr.	>1:10 yr	x £k	<1:10 yr.	>1:10 yr	
South of Ystwyth	0	0	0	0	0	0	0	0	0	0	0	0
North of Ystwyth	0	2	0.04	0	2	0.57	0	2	17	0	3	59
Southern Marina	0	143	92	0	146	110	0	151	673	0	157	4724
South of Rheidol	0	0	0	0	0	0	0	0	0	0	2	0
Rest of Aberystwyth	0	490	310	0	639	441	0	829	3555	0	1139	20576
Clarach	0	5	41	0	5	49	5	2	492	7	1	2705
<b>Total for PDZ9</b>												28064
With Present Management	No. of properties		AAD x £k	No. of properties		AAD x £k	No. of properties		AAD x £k	No. of properties		PVD (£x1000)
<i>Location</i>	<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr		<1:10 yr.	>1:10 yr	
South of Ystwyth	0	0	0.04	0	0	0.49	0	0	1.89	0	0	0
North of Ystwyth	0	2	46	0	2	55	0	2	67	0	3	11
Southern Marina	0	143	0	0	143	0	0	151	0	0	157	1531
South of Rheidol	0	0	0	0	0	0	0	0	0	0	2	0
Rest of Aberystwyth	0	490	41	0	490	6	0	829	4308	0	1139	6422
Clarach	0	5	0	0	5	0	0	7	0	7	1	813
<b>Total for PDZ9</b>												8778

**Table 2. General Assessment of Objectives**

The following table provides an overall assessment of how the two baseline scenarios impact upon the overall objectives. Specific objectives are set out in more detail within Appendix E. The table aims to provide an initial high level assessment of the two baseline scenarios, highlighting potential issues of conflict. These issues are discussed in the following section, examining alternative management scenarios from which SMP2 policy is then derived.

STAKEHOLDER OBJECTIVE	NAI			WPM		
	Fails	Neutral	Acceptable	Fails	Neutral	Acceptable
Reduce risk to life	Fails					
Protect properties from flood and erosion loss	Fails					
Minimise the need for increasing effort and management of coastal defences		Neutral			Neutral	
Avoid reliance on defence particularly where there is a risk of catastrophic failure					Neutral	
Maintain access to the communities and villages		Neutral				Acceptable
Maintain Aberystwyth as regional centres for the communities	Fails				Neutral	
Maintain recreational use of beaches	Fails			Fails		
Maintain access to the coast including car parking and facilities	Fails			Fails		
Maintain access for boat use and associated recreational activity	Fails					Acceptable
To maintain Aberystwyth as a viable commercial centre and support opportunities for regeneration	Fails			Fails		
To maintain the use and development of Aberystwyth Harbour	Fails					Acceptable
To maintain the important national commercial, social and cultural centre of Aberystwyth	Fails			Fails		
Maintain character and integrity of coastal communities		Neutral			Neutral	
Identify risk and reduce risk of loss of heritage features where possible		Neutral			Neutral	
Maintain historic landscape		Neutral			Neutral	
Prevent disturbance or deterioration to historic sites and their setting	Fails			Fails		
Maintain or enhance the condition or integrity of the international (SAC, SPA) designated sites and interest features within the context of a dynamic coastal system.			Acceptable			Acceptable
Maintain or enhance the condition or integrity of the national (SSSI) designated sites and interest features within the context of a dynamic coastal system.			Acceptable	Fails		
Maintain and enhance educational and scientific understanding of geology and geomorphology			Acceptable		Neutral	
Avoid damage to and enhance the natural landscape.			Acceptable	Fails		
Maintain the human landscape and character of communities	Fails			Fails		
Maintain access to larger settlements for smaller farming communities	Fails			Fails		
Maintain regional transport route	Fails			Fails		

## 5 Discussion and Detailed Policy Development

No Active Intervention, while generally fulfilling objectives with respect to the natural function of large areas of the zone, would be unacceptable in relation to Aberystwyth. However, extending the present intent of management across the Aberystwyth area is equally shown not to meet core objectives. It is accepted that the discussion above is extending a present attitude to defence to an extreme and that, in reality, this intent is likely to actually respond to the changing conditions of sea level rise and as the coastal form changes. However, the discussion highlights that that change will be necessary and will need to be undertaken in a planned manner rather than as a reaction to events.

The main discussion in developing policy is focussed on the Aberystwyth frontage.

Over the coast to the south of Tan y Bwlch, the present policy is seen as appropriate. There will be some erosion and set back of the coast at Morfa Bychan, but to attempt to defend against this would be unsustainable in the long term. There will be loss of land at the crest of the cliff. This in many areas is considered to be important habitat and it would be sensible that land use is moved back in line with the eroding crest.

At Tan y Bwlch, it is not realistic economically or technically to defend against the breach through to the Ystwyth. The existing defence might be manageable over epoch 1. The defence of the river embankments may stop normal tidal flooding over the same period of time, possibly even over epoch 2. However, in epoch 3, there would need to be extensive raising of the defences and quite probably a system of pumped drainage. Public funding would be very unlikely and even private investment in defence improvements would not be considered realistic. The policy here changes to managed realignment over epochs 1 and 2, with No Active intervention in epoch 3. This reflects the need to adjust the existing approach in the present and the long term expectation that no defence would be provided in the future.

It is probable, that the above approach would create a new entrance to the Ystwyth. This would help to reduce erosion of the shingle bank to either side and to allow a more natural realignment of the coast to the north in protecting the root of the Stone Pier. It would, however, mean that the flow from the Ystwyth no longer acts to flush the harbour entrance. This would be mitigated to some degree by the anticipated increase in flows and tidal prism of the Rheidol.

The Pier would be maintained as an essential feature maintaining navigation and providing protection to the shoreline to the north. The harbour is seen as being an essential aspect of Aberystwyth with important regional benefit in maintaining the traditional fishing effort and as a core identity of the town. The marina is seen as being sustainable in to the future but as with the main commercial quay there would need to be investment in the future to adapt operation in line with sea level rise. This would need to be undertaken with joint funding and reliance could not be put on funding from principally from flood and coastal risk management grant. There are issues however, in relation to flood risk management from the river frontage to Trefechan. One aspect of this would also be the sustainability of the old bridge under more extreme sea level rise. Neither raising defences nor purely managing the consequence of increased flood risk in the area is seen as being sustainable in the long term. It seems more probable that additional width would be needed to sustain an acceptable level of risk from this rear defence to Trefechan. The intent would be to sustain a defence in the area but this may require the loss of some property to do this. This then becomes a long term planning issue rather than one that can be managed purely by defence policy. Without such an

approach, it may be possible to maintain and raise defences over epochs 1 and 2, but the default policy would then be to realign defence back to the road. This would maintain access to the properties to the western side of Trefechan and properties within the marina. The general SMP policy for Trefechan would therefore be for Hold the Line in epochs 1 and 2, but either then planned adaptation or retiring the river defence over epoch 3. In either event the policy in epoch 3 would be for Managed Realignment.

The high value and essential function as the administrative and commercial centre of Aberystwyth, means that the policy for the northern section of the Rheidol Valley would be Hold the Line over all epochs. While the approach taken by the CFMP would assist this through planning control and through improved sustainable drainage, the main commitment has still to be to raise the level of defences in line with sea level rise. This is likely to result in the further need for pumped drainage in the future. However, taking a view beyond the period of the SMP, continuing to focus regeneration on this central area will incur significant continued effort to maintain essential flood risk management. This is again beyond the remit of the SMP to resolve and is highlighted as a major issue that needs to be addressed through spatial planning of the whole Aberystwyth area.

Alongside this is the key issue in relation to sustaining the railway route in areas north of Aberystwyth, within the Dyfi Estuary. This is discussed in PDZ 10 of the SMP. The assessment of the plan in this area highlights that the railway will potentially, during epoch 3, become unsustainable without major work and that to continue to maintain the route of the railway as a continuous barrier will severely constrain the natural function of the estuary. The recommendation of the SMP2 would be for realignment but this could not be achieved without much more detailed consideration of transport policy in this area of Wales at a national level.

In adopting a policy to maintain and sustain operation of the harbour, there will be a need to maintain the ridge of land to the seaward face of the harbour. The current approach suggested by the strategy is to reinforce this defence and to raise the crest of the defence here and along South Marine Terrace. In the future this is likely to require a much reinforced line of defence along the whole frontage as beach levels drop. This would not be seen as being sustainable in the long term, without significant impact on the use and value of the area. The approach would create a more vulnerable defence. There is scope for reconsidering options for future management. Increasing the linear defence along the harbour ridge might be seen as being appropriate and in line with this. This would tend to reduce scour and wave action at the southern end of South Marine Terrace. At the northern end there is the opportunity to increase the effectiveness of the north groyne, replacing the simple linear structure with some form of cross shore breakwater. This then creates the potential to retain a larger beach in front of South Marine Terrace. The strategy finds that continuing a linear approach would be economically justified under a 0.5m sea level rise, typically over epochs 1 and 2, based on the latest estimates. The more expensive option of controlling the beach and providing a more adaptable approach to management of the shore is considered more in line with the principles of sustainability and in keeping with use of the area. There would still be a need to arise the defence level but through increasing the protection provided by the beach would allow a reduced level of defence.

Taking different approach to management of the Castle Rock Groyne would provide the opportunity to reduce waves approaching the sea wall and would allow defence in this area to be sustained without having to raise defences to an unacceptable level.

There are the same difficulties identified above with sustaining the defences along Marine Terrace and Victoria Terrace. The main problem at Marine Terrace is the present level of the promenade. This could be addressed, as suggested by the strategy by raising the defence through landscaped defence over the promenade area. However, with future loss of beach and the need to raise defences still further to prevent wave overtopping into the town, this begins to make the approach unsustainable in terms of visual appearance and function of the sea front. At Victoria Terrace there would be a need for a full rock revetment in the future and raised crest wall. The impact here might be less significant but there would be continuing concern that as overtopping increases so use of properties may suffer. The opportunity exists to reshape the whole frontage. In principle this would still be a policy of Hold the Line. However, the approach would be to control the beach using offshore or shore-linked structures. Potentially structures could be developed at the Pier, and at the Weg. This would need to be considered further. In taking such an approach forward the opportunity arises to make use of such control points providing increased benefit and potential for additional funding. In particular the opportunity would exist to create a new headland in the area of the Weg as a useable extension of the promenade area, rather than merely as a typical rock structure. To the northern end of Victoria Terrace, under this general approach to create width for development and retention of a beach, there may be a need to allow some readjustment of the existing line of defence at the end of the Terrace. This should be recognised in terms of future planned development of property in this location.

The intention is therefore to maintain defence to the sea front of the town and this is seen as being sustainable. However, to sustain the use of the frontage the SMP highlights the very probable need to adapt from the linear approach of defence.

In the study by Pethick<sup>2</sup> it was identified that the alignment of Victoria Terrace was too far forward of the natural swash aligned coast and it was because of this that this frontage came under greatest pressure. This is confirmed by the SMP. Pethick, therefore, recommended the possible approach of Managed realignment. This study was viewing management principally from the perspective of natural processes. However, setting back the defence in this area would be difficult to implement and would substantially increase the flood risk through the town. Setting back the defence would, therefore, require construction of a new and improved defence further back.

The main point being highlighted, initial by Pethick, within the Aberystwyth Strategy Study and the SMP, is that sustaining the existing line of Victoria Terrace, and to a lesser degree Marine Terrace, will present significant problems in the longer term. The approach taken by the SMP to address this is to examine the opportunity to advance the defence line, not as a linear defence but in providing new headlands and features controlling and allowing a beach to be retained along the important sea front.

At Clarach Bay the present plan for retreat is confirmed in this review. This will require adaptation of the main frontage and at the northern end. In the central area, the flood and erosion risk would not substantially increase over the first epoch. During epoch 2, pressure will increase and there is likely to be a need to move properties away from this area. Such adaptation would need to be managed in developing a plan with the various local land owners and residents. Over this frontage, private defence would be discouraged as having a potentially detrimental impact on the SSSI and on the ability for the shoreline to adjust in the future. At the northern end, the erosion north of the stream is likely to lead to loss of buildings associated with the main centre of the caravan park.

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<sup>2</sup> Pethick J., Orford J., and Young R., March 2003

The approach here would be to work with the caravan park to allow time for adaptation. This would not be seen critically impacting on the overall development for the bay during epoch 1 and potentially even in epoch 2. The overall approach provides opportunity to sustain a good area of beach and at the same time to allow development within the valley of sustainable natural habitat. Both aims could enhance future opportunities for the continued recreational and tourism use of the area.

The recommended policy at Wallog is No Active Intervention, however this will not preclude private works to Wallog House, subject to the appropriate approvals. The main risk is future sea level rise and it is recognised that there is mutual benefit in sustaining the defence of the quay, in supporting the coastal footpath, extending the life of the lime kiln and in providing protection to the property.

## 6 Management Summary

The zone is divided into two basic management areas. The main interaction in terms of management is in relation to the Aberystwyth frontage extending from Tan y Bwlch through to Constitution Hill. A summary of the policies are provided in the tables below.

### M.A.17 ABERYSTWYTH: From Carreg Ti Pw to Constitution Hill.

Policy Unit		Policy Plan			Comment
		2025	2055	2105	
9.1	Carreg Ti Pw to Allt Wen	NAI	NAI	NAI	
9.2	Tan y Bwlch	MR	MR	NAI	The long term intent would be to allow a breach through to the Ystwyth but to manage this initially in discussion with landowners with respect to long term management of the new inlet.
9.3	Aberystwyth Harbour	HTL	HTL	HTL	This would be subject to joint funding and involve adaptation of operational use.
9.4	Glanyrafon Terrace	HTL	HTL	MR	There will need to be a planned response to development of the Trefechan area.
9.5	Rheidol Valley south	MR	MR	MR	Local adaptation to increased risk.
9.6	Rheidol Valley north	HTL	HTL	HTL	This would include raising defences but beyond the period of the SMP there may need to be further adaptation.
9.7	South Marine Terrace	HTL	HTL	HTL	Management approach is expected to change to managing the alignment of the shoreline and committing to beach recharge.
9.8	Castle Hill	HTL	HTL	HTL	Management approach is expected to change to managing wave exposure.
9.9	Marine Terrace and Victoria Terrace	HTL	HTL	HTL/A	Management approach is expected to change to managing the alignment of the shoreline and committing to beach recharge, with the possible opportunity for reclaiming land to control the shoreline..
9.10	Constitution Hill to Clarach	NAI	NAI	NAI	
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

**M.A.18 CLARACH AND WALLOG:** From Constitution Hill to Sarn Gynfelyn.

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
9.11	Clarach Bay	MR	MR	MR	This would require working with the local community and landowners to allow adaptation.
9.12	Glan y Mor Cliffs	NAI	NAI	NAI	
9.13	Wallog	NAI	NAI	NAI	No active intervention, but does not preclude private works to Wallog House in the short term subject to necessary approvals
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

**PDZ9**  
**Management Area Statements**

**MA 17 Aberystwyth**  
*Carreg Ti Pw to Constitution Hill*

**MA 18 Clarach and Wallog**  
*Constitution Hill to Sarn Gynfelyn*

<b>Location reference:</b>	<b>Aberystwyth</b>
<b>Management Area reference:</b>	<b>M.A. 17</b>
<b>Policy Development Zone:</b>	PDZ9

\* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change, these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan, reference should be made to the baseline data.

The following descriptions are provided to assist interpretation of the map shown overleaf.

### 100 year shoreline position:

The following maps aim to summarise 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.

-  In some areas the preferred policy does not change from that under the existing management approach. In some areas where there are hard defences this can be accurately identified. In other areas there is greater uncertainty. Even so, where the shoreline is likely to be quite clearly defined by a change such as the crest of a cliff the estimated position is shown as a single line.
- Where there is a difference between With Present Management and the Draft Preferred Policy this distinction is made in showing two different lines:

-  With Present Management.
-  Draft Preferred Policy.

### Flood Risk Zones



General Flood Risk Zones. The explanation of these zones is provided on the Environment Agency's web site [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk). The maps within this Draft SMP document show where SMP policy might influence the management of flood risk.



Indicate areas where the intent of the SMP draft policy is to continue to manage this risk.

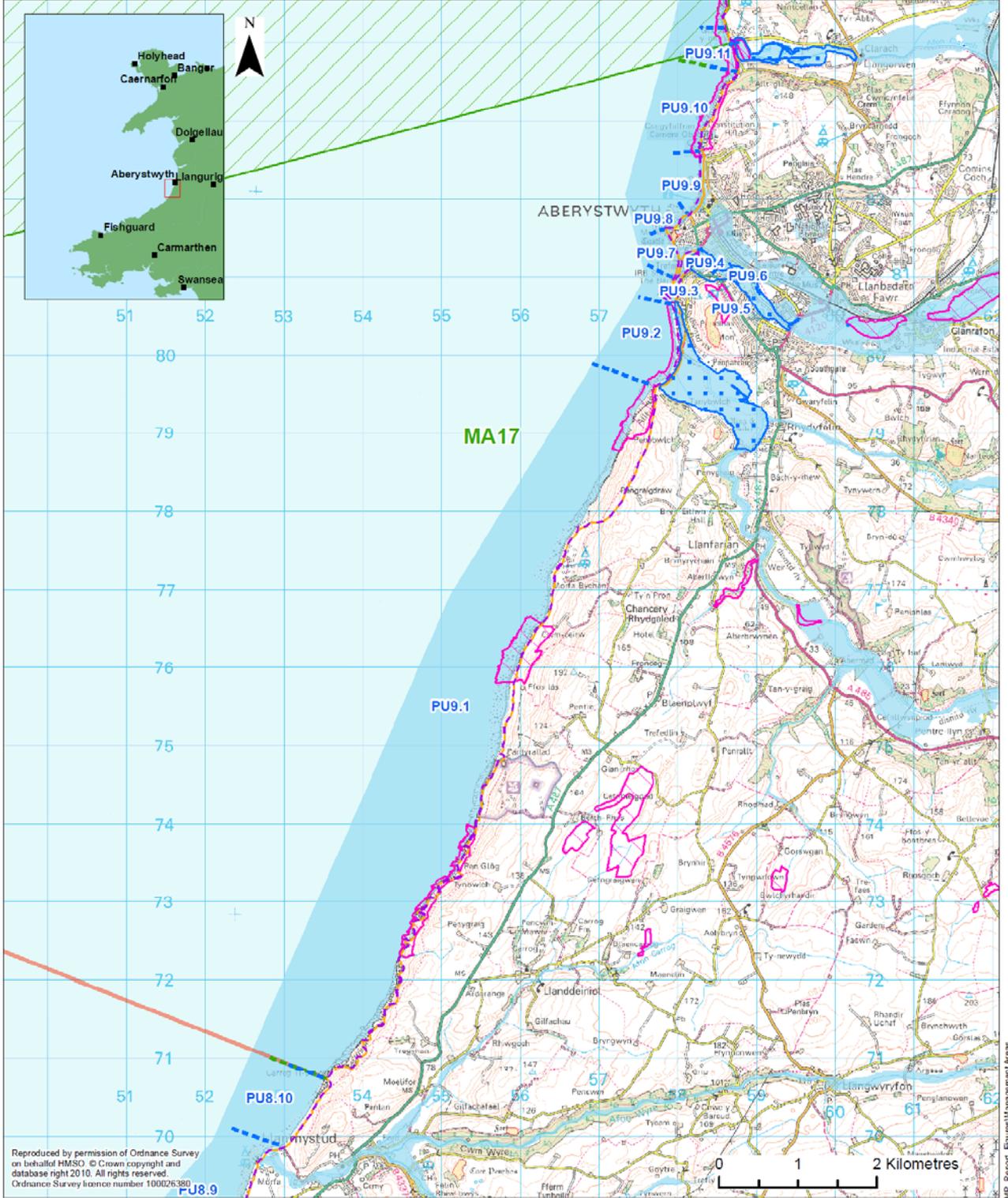


Indicate where over the 100 years the policy would allow increased risk of flooding.

The maps should be read in conjunction with the text within the Draft SMP document.

**Shoreline Management Plan Sub Cell 10  
Baseline Location Map  
Management Area 17**

- Management Area
- Policy Unit
- Policy Development Zone
- Scheduled Monument



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<p><b>Key</b></p> <p>100 Year Shoreline Position:</p> <ul style="list-style-type: none"> <li><span style="border-bottom: 1px dashed orange; width: 20px; display: inline-block;"></span> Preferred Policy would be the same as With Present Management</li> <li><span style="border-bottom: 1px solid orange; width: 20px; display: inline-block;"></span> With Present Management where this differs from the Preferred Policy</li> <li><span style="border-bottom: 1px dashed purple; width: 20px; display: inline-block;"></span> Preferred Policy where this differs from the With Present Management</li> </ul>		<ul style="list-style-type: none"> <li><span style="border: 1px solid orange; width: 15px; height: 10px; display: inline-block;"></span> Ramsar</li> <li><span style="border: 1px solid green; width: 15px; height: 10px; display: inline-block;"></span> SAC</li> <li><span style="border: 1px solid blue; width: 15px; height: 10px; display: inline-block;"></span> SPA</li> <li><span style="border: 1px solid pink; width: 15px; height: 10px; display: inline-block;"></span> SSSI</li> <li><span style="border: 1px solid lightgreen; width: 15px; height: 10px; display: inline-block;"></span> NNR</li> </ul>	<ul style="list-style-type: none"> <li><span style="background-color: lightblue; width: 15px; height: 10px; display: inline-block;"></span> Existing Indicative EA Flood Zone 3</li> <li><span style="background-color: lightblue; border: 1px dotted blue; width: 15px; height: 10px; display: inline-block;"></span> EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding</li> </ul>	
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## SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

### INTENT OF THE PLAN:

The intent of the plan is to sustain defence Aberystwyth, while allowing the natural development of the coast in adjacent areas. To the south of Aberystwyth the various sections of the cliffed coastline would be allowed to erode naturally. At Tan y Bwlch the aim of the plan would be to restore the frontage to its natural condition, moving away from maintenance of the existing defences with the intention to allow flooding of the land behind. This approach would need to be developed with the landowner and to consider how this could allow adaptation of existing agricultural use while supporting opportunity for habitat creation and enhancement. Locally, up stream, consideration would need to be given to flood risk management. Developing this approach would need to take account of potential interaction within Aberystwyth Harbour.

The Pier would be maintained as would the operation and use of the harbour area. Defences would be improved and raised. Within the Rheidol defence, to the back of Trefechan, would be maintained but to achieve there would need to be consideration of defence management along Glanyrafon Terrace. The aim of the plan would be to set back defences in the longer term to provide a more sustainable defence of the whole area. This would compliment the approach of allowing natural development of the South Rheidol area.

The area to the north of the Rheidol forms the newly developed commercial core of Aberystwyth. The defence to this area would be maintained and raised as necessary. However, the plan identifies the increasing flood risk to the area with sea level rise and recommends that planning take account of this, with the need to develop a longer term ( beyond 100 years) for greater opportunity for adaptation.

The aim of the plan is to maintain and improve defences along South Marine Terrace, Marine Terrace and Victoria Terrace. There is a risk that by epoch 3, with sea level rise, purely increasing the size and height of defences may impact severely on the use, character and value of the sea front. As a result, in looking to management of these defences, even during epochs 1 and 2, there may need to be alternative approaches to address the long term wave overtopping and loss of beach area. The SMP identifies the potential opportunity for advancing the line along the main sea front with potential opportunity for collaborative funding.

### KEY ISSUES/RISK AND UNCERTAINTY:

There are uncertainties in terms of timing of the proposed changes and for the developing increased risk and pressure at the coast. There is a need to monitor this and for a detailed planned response to change. It will be important to relate this to national monitoring of sea level rise and more general climate change.

While there is overall seen as being good economic justification fro maintain defence to Aberystwyth, there may be the need to examine alternative collaborative funding approaches aimed at sustaining the character and use of the area, over and above merely FCERM.

## ACTIONS:

ACTION	PARTNERS	
Shoreline monitoring	<b>CSC</b>	
Adaption planning at Tan y Bwlch, with opportunity for habitat creation.	<b>CSC</b> <b>Landowner</b>	<b>EA</b> <b>CCW</b>
Long term adaptive planning for Aberystwyth Harbour and Trefechan.	<b>CSC</b> <b>Harbour users</b> <b>Highways</b>	<b>EA</b>
Long term integrated development of the Aberystwyth sea front.	<b>CSC</b> <b>Community</b>	<b>EA</b>
Habitat creation within the Rheidol Valley	<b>CSC</b>	<b>CCW</b>

## DELIVERY OF THE PLAN

### SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
9.1	Carreg Ti Pw to Allt Wen	NAI	NAI	NAI	
9.2	Tan y Bwlch	MR	MR	NAI	The long term intent would be to allow a breach through to the Ystwyth but to manage this initially in discussion with landowners with respect to long term management of the new inlet.
9.3	Aberystwyth Harbour	HTL	HTL	HTL	This would be subject to joint funding and involve adaptation of operational use.
9.4	Glanyrafon Terrace	HTL	HTL	MR	There will need to be a planned response to development of the Trefechan area.
9.5	Rheidol Valley south	MR	MR	MR	Local adaptation to increased risk.
9.6	Rheidol Valley north	HTL	HTL	HTL	This would include raising defences but beyond the period of the SMP there may need to be further adaptation.
9.7	South Marine Terrace	HTL	HTL	HTL	Management approach is expected to change to managing the alignment of the shoreline and committing to beach recharge.
9.8	Castle Hill	HTL	HTL	HTL	Management approach is expected to change to managing wave exposure.
9.9	Marine Terrace and Victoria Terrace	HTL	HTL	HTL/ A	Management approach is expected to change to managing the alignment of the shoreline and committing to beach recharge, with the possible opportunity for reclaiming land to control the shoreline..
9.10	Constitution Hill to Clarach	NAI	NAI	NAI	
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
<b>From present day</b>	Maintain existing defences to Aberystwyth. Develop adaption plans. Adopt managed realignment at Tan y Bwlch.
<b>Medium term</b>	Maintain existing defences to Aberystwyth. Develop adaption plans. Consider future investment along Aberystwyth sea front.
<b>Long term</b>	Maintain existing defences to Aberystwyth. Implement adaption plan for Glanyrafon Terrace. Review flood risk within the Ystwyth Valley.

## IMPLICATIONS OF THE PLAN

### CHANGES FROM PRESENT MANAGEMENT

The policy at Tan y Bwlch changes to MR. The aim of management remains the same for Aberystwyth but with the need for adaption planning.

### ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	5,032.5	5,318.9	17,491.2	27,842.7
Preferred Plan Damages	2,667.4	2,820.0	4,398.0	9,885.4
Benefits	2,365.2	2,498.9	13,093.2	17,957.3
Costs	2,296.0	2,175.1	620.8	5,091.9

### FLOOD AND EROSION RISK MANAGEMENT

#### POTENTIAL LOSS

There is the potential loss of 2 properties north of Aberystwyth. There is the potential for increased flood risk to properties at Trefechan subject to development of adaption plan.

#### BENEFITS OF THE PLAN

The plan provides a longer term sustainable approach to defence, sustaining the important sea front and harbour area of Aberystwyth. 180 properties currently identified at risk from erosion would be protected. Over 1000 properties would benefit from flood defence or improved flood defence.

**SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)**

PDZ 9				
SEA Objective	Impact of Preferred Policy for each Epoch			
	1	2	3	Mitigation
<b>Policy Units 9.1 to 9.13</b>				
To support natural processes, maintain and enhance the integrity of internationally designated nature conservation sites. Maintain / achieve favourable condition of their interest features (habitats and species).				
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				
To avoid adverse impacts on, conserve and where practical enhance national and local BAP habitats.				Habitat creation
To support natural processes and maintain geological exposures throughout nationally designated geological sites.				
To conserve and enhance nationally designated landscapes in relation to risks from coastal flooding and erosion and avoid conflict with AONB and National Park Management Plan Objectives.				
To minimise coastal flood and erosion risk to scheduled and other internationally and nationally important cultural heritage assets, sites and their setting.				Excavation and recording
To minimise the impact of policies on marine operations and activities.				
To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services.				
To minimise coastal flood and erosion risk to agricultural land and horticultural activities.				
To minimise coastal flood and erosion risk to people and residential property.				Relocation
To minimise coastal flood and erosion risk to key community, recreational and amenity facilities.				
To minimise coastal flood and erosion risk to industrial, commercial, economic and tourism assets and activities.				

Opportunities for habitat creation should be considered at Tan y Bwlch and within the Rheidol Valley.

**This table provides a summary of the SEA (appendix E) and reference should be made to the Appendix for full details of the assessment.**

**These next two sections provide a headline summary of the findings of the HRA (Appendix G) and the WFA (Appendix H). Reference should be made as appropriate to these Appendices for full details.**

## **HRA SUMMARY**

The SMP policy in this PDZ provides a range of policies along the coastline including NAI, HTL and MR. PDZ 9 includes interest features of the Pen Llyn a`r Sarnau / **Llyn Peninsula** and the Sarnau SAC.

The various policies do not result in a constraint to the development of the Pen Llyn a`r Sarnau/ **Llyn Peninsula** and the Sarnau SAC habitats in response to sea level rise, and as such there will be **no adverse effect on the integrity of the SAC**.

**SUMMARY CONCLUSION FROM THE WATER FRAMEWORK ASSESSMENT**

Water body (and relevant PDZ)	Environmental Objectives met?				WFD Summary Statement required?	Achievement of Any South East RBMP Mitigation Measures?	Details on how the specific South East RBMP Mitigation Measures have been attained (dark green = achieved; light green = partly achieved & red = not achieved)
	WFD 1	WFD2	WFD3	WFD4			
<b>Ystwyth/ Rheidol (Transitional)</b>  (PDZ part 9) (MAN part 17)	N/A	<b>x</b> (PDZ 9)	✓	✓	<b>Yes</b> – Environmental Objective WFD2 may not be met because of the SMPs policy in PDZ 9 (MAN 17).	<b>Yes (partly)</b> – One of the six relevant mitigation measures for this water body has been implemented, which then provides potential for other measures to be put in place.	<ul style="list-style-type: none"> <li>• <b>Managed realignment of flood defence</b> – MR of the south side of Rheidol Valley (<b>PU 9.5</b>) will allow the estuary to roll back and create further intertidal habitats.</li> <li>• <b>Bank rehabilitation / re-profiling</b> – could be implemented as part of the MR.</li> <li>• <b>Remove obsolete structure</b> – if there are obsolete structures in place along the MR location these could be removed.</li> <li>• <b>Retain marginal aquatic and riparian habitat</b> – MR will result in creating marginal habitats.</li> <li>• <b>Offsetting measures</b> – not considered.</li> <li>• <b>Operation and structural changes to locks etc</b> – not feasible.</li> </ul>

Further details of this assessment are provided in Appendix K and are summarised below.

Water body (including the PUs that affect it)	WFD Summary Statement checklist	A brief description of decision making and reference to further documentation within the SMP
<b>Ystwyth / Rheidol (Transitional – T4)</b>  <b>PU 9.3, 9.4, 9.6 &amp; 9.7</b> (WFD 2)	<b>Mitigation measures:</b> have all practicable mitigation measures been incorporated into the preferred SMP policies that affect this water body in order to mitigate the adverse impacts on the status of the water body? If not, then list mitigation measures that could be	<b>RBMP mitigation measures incorporated into SMP policies:</b> <ul style="list-style-type: none"> <li>• One of the mitigation measures in the Western Wales RBMP for this transitional water body is to be implemented through the SMP2 policies within PDZ 9, which is the MR of the south side of inner Rheidol Estuary ('Rheidol Valley south'). This will allow the natural realignment of this part of the estuary enabling the estuary to adapt and evolve in response to sea level rise, by eroding back and accreting sediments along the foreshore, and thus improve the benthic invertebrate communities within the estuary. In the long term there could also be potential for the establishment of saltmarsh habitats. This policy also has the potential to achieve other mitigation</li> </ul>

Water body (including the PUs that affect it)	WFD Summary	Statement	A brief description of decision making and reference to further documentation within the SMP
	required.		<p>measures, though this will depend on how the MR is determined, for example, bank rehabilitation / re-profiling, preserve and where possible enhance ecological value of marginal aquatic habitats, banks and riparian zone, and retain marginal aquatic and riparian habitats (channel alteration).</p> <ul style="list-style-type: none"> <li>Furthermore, the long term MR and NAI at Tan y Bwlch will allow the Ystwyth to realign and flow through the centre of this bay, which will result in the improvement of the morphology and flow of this river and improve associated BQEs such as benthic invertebrates, saltmarsh and migratory fish pathways. This policy will have inadvertently put in place the following RBMP mitigation measures: removal of hard bank / revetment, preserve, and where possible restore historic aquatic habitats, and increase in-channel morphological diversity.</li> </ul> <p><b>Other potential mitigation measures that could be required:</b></p> <ul style="list-style-type: none"> <li>Undertake a study/strategy to investigate the time frame and options for MR at Tan y Bwlch, as well as undertake consultation with key stakeholders (i.e. landowners of the land around the Ystwyth River mouth.</li> <li>Undertake a study to investigate the MR options on the south side of the Rheidol inner estuary to determine how this policy can best implement the RBMP mitigation measures to ensure that Good Ecological Potential can be achieved by 2027.</li> </ul>
	<b>Other issues:</b> Can it be shown that there are no other over-riding issues that should be considered (e.g. designated sites, recommendations of the Appropriate Assessment)?		This water body includes part of Allt Wen A Traeth Tanybwloch SSSI along the coastal front adjacent to the mouth of the Ystwyth River (i.e. landward of Tan Y Bwlch), and which is designated for its complex geological structures in the cliffs. This designation does not extend within the harbour and is not affected by the HTL policies. There are no Natura 2000 sites within or adjacent to the estuary.

<b>Location reference:</b>	<b>Clarach and Wallog</b>
<b>Management Area reference:</b>	<b>M.A. 18</b>
<b>Policy Development Zone:</b>	PDZ9

\* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change, these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan, reference should be made to the baseline data.

The following descriptions are provided to assist interpretation of the map shown overleaf.

**100 year shoreline position:**

The following maps aim to summarise 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.

-  In some areas the preferred policy does not change from that under the existing management approach. In some areas where there are hard defences this can be accurately identified. In other areas there is greater uncertainty. Even so, where the shoreline is likely to be quite clearly defined by a change such as the crest of a cliff the estimated position is shown as a single line.
- Where there is a difference between With Present Management and the Draft Preferred Policy this distinction is made in showing two different lines:

-  With Present Management.
-  Draft Preferred Policy.

**Flood Risk Zones**

-  General Flood Risk Zones. The explanation of these zones is provided on the Environment Agency’s web site [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk). The maps within this Draft SMP document show where SMP policy might influence the management of flood risk.
-  Indicate areas where the intent of the SMP draft policy is to continue to manage this risk.
-  Indicate where over the 100 years the policy would allow increased risk of flooding.

The maps should be read in conjunction with the text within the Draft SMP document.

**Shoreline Management Plan Sub Cell 10  
Baseline Location Map  
Management Area 18**

- Management Area
- Policy Unit
- Policy Development Zone
- Scheduled Monument



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Key	
<span style="color: red;">—</span> 100 Year Shoreline Position:	<span style="border: 1px solid orange; padding: 2px;"> </span> Ramsar
<span style="color: blue;">—</span> Preferred Policy would be the same as With Present Management	<span style="border: 1px solid green; padding: 2px;"> </span> SAC
<span style="color: orange;">—</span> With Present Management where this differs from the Preferred Policy	<span style="border: 1px solid blue; padding: 2px;"> </span> SPA
<span style="color: purple;">—</span> Preferred Policy where this differs from the With Present Management	<span style="border: 1px solid pink; padding: 2px;"> </span> SSSI
	<span style="border: 1px solid lightgreen; padding: 2px;"> </span> NNR
	<span style="background-color: lightblue; border: 1px solid blue; padding: 2px;"> </span> Existing Indicative EA Flood Zone 3
	<span style="background-color: lightblue; border: 1px dashed blue; padding: 2px;"> </span> EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding



## SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

### INTENT OF THE PLAN:

Maintaining defence to the low lying seafront at Clarach is not seen as being sustainable in the future. The aim of the plan is to realign/undertake some maintenance to the defences to support adaptation.

At Wallog, local defences are maintained privately. This work helps support the coastal path and heritage features. The plan in this area is for NAI but with an intent to support or facilitate private works in this area.

The plan would allow natural development of the entire frontage with the opportunity for habitat creation within the Clarach Valley.

### KEY ISSUES/RISK AND UNCERTAINTY:

There are uncertainties in terms of timing of the proposed changes. There is also a need for a detailed planned response to change. It will be important to relate this to national monitoring of sea level rise and more general climate change.

### ACTIONS:

ACTION	PARTNERS
Shoreline monitoring	<b>CSC</b>
Adaption planning at Clarach	<b>Landowners EA Community</b> <b>CSC</b>
Plan relocation of coastal path and discuss in relation to private management of defences at Wallog.	<b>CSC Landowner</b>

## DELIVERY OF THE PLAN

### SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			Comment
		2025	2055	2105	
9.11	Clarach Bay	MR	MR	MR	This would require working with the local community and landowners to allow adaptation.
9.12	Glan y Mor Cliffs	NAI	NAI	NAI	
9.13	Wallog	NAI	NAI	NAI	No active intervention, but does not preclude private works to Wallog House in the short term subject to necessary approvals
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
<b>From present day</b>	Maintenance of critical defences in support of adaption.
<b>Medium term</b>	Support adaption
<b>Long term</b>	Support adaption

## IMPLICATIONS OF THE PLAN

### CHANGES FROM PRESENT MANAGEMENT

No substantial change in approach.

### ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	511.7	549.2	1,711.5	2,772.4
Preferred Plan Damages	511.7	308.0	1,574.1	2,393.8
Benefits	0.0	241.2	137.4	378.7
Costs	0.0	125.6	0.0	125.6

### FLOOD AND EROSION RISK MANAGEMENT

#### POTENTIAL LOSS

There is likely to be loss of property and increased risk of flooding to Holiday Parks.

#### BENEFITS OF THE PLAN

The plan allows time and support for adaptation, creating long term sustainable management for use of the area and opportunity for habitat creation.

**SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)**

PDZ 9				
SEA Objective	Impact of Preferred Policy for each Epoch			
	1	2	3	Mitigation
<b>Policy Units 9.1 to 9.13</b>				
To support natural processes, maintain and enhance the integrity of internationally designated nature conservation sites. Maintain / achieve favourable condition of their interest features (habitats and species).				
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				
To avoid adverse impacts on, conserve and where practical enhance national and local BAP habitats.				Habitat creation
To support natural processes and maintain geological exposures throughout nationally designated geological sites.				
To conserve and enhance nationally designated landscapes in relation to risks from coastal flooding and erosion and avoid conflict with AONB and National Park Management Plan Objectives.				
To minimise coastal flood and erosion risk to scheduled and other internationally and nationally important cultural heritage assets, sites and their setting.				Excavation and recording
To minimise the impact of policies on marine operations and activities.				
To minimise coastal flood and erosion risk to critical infrastructure and maintain critical services.				
To minimise coastal flood and erosion risk to agricultural land and horticultural activities.				
To minimise coastal flood and erosion risk to people and residential property.				Relocation
To minimise coastal flood and erosion risk to key community, recreational and amenity facilities.				
To minimise coastal flood and erosion risk to industrial, commercial, economic and tourism assets and activities.				

Opportunities for habitat creation should be considered with the Clarach Valley.

**This table provides a summary of the SEA (appendix E) and reference should be made to the Appendix for full details of the assessment.**

**These next two sections provide a headline summary of the findings of the HRA (Appendix G) and the WFA (Appendix H). Reference should be made as appropriate to these Appendices for full details.**

#### **HRA SUMMARY**

The SMP policy in this PDZ provides a range of policies along the coastline including NAI, HTL and MR. PDZ 9 includes interest features of the Pen Llyn a`r Sarnau / **Llyn Peninsula** and the Sarnau SAC.

The various policies do not result in a constraint to the development of the Pen Llyn a`r Sarnau/ **Llyn Peninsula** and the Sarnau SAC habitats in response to sea level rise, and as such there will be **no adverse effect on the integrity of the SAC**.

**SUMMARY CONCLUSION FROM THE WATER FRAMEWORK ASSESSMENT**

This area was scoped out of further assessment.