PDZ 20. CONWY:

Garizim to the Great Orme

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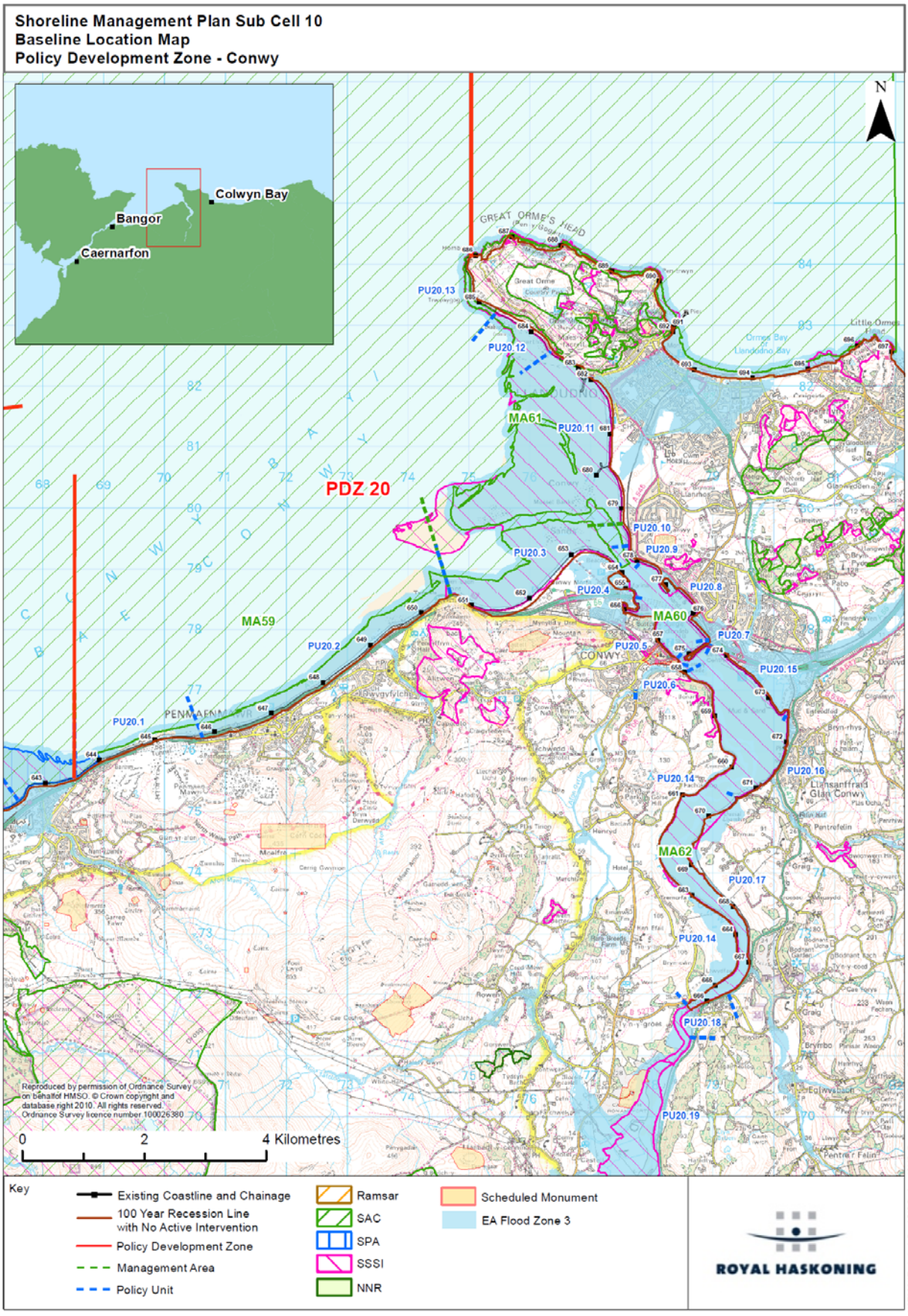
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Definitions of Scenarios Considered in Policy Development

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

The Southern Shoreline

This zone covers the eastern side of Bae Conwy and through into the Conwy estuary and up stream to Llanrwst in the Conwy valley. The zone picks up from the policy development zone to the west at the end of Llanfairfechan, from where the dominant feature of the coast is the main A55 and railway line running close to, or effectively at the back of the shoreline all the way through to the tunnel at Pen-y-clip. The land rises steeply in land of the shoreline, with the village of Garizim on this higher ground on the western slopes of the massive Penmaenmawr headland.

Between the Penmaenmawr (Pen-y-Clip) and Penmaen-bach headland, to the east, are the two valleys of the Fern Brook, culverted through the village of Penmaenmawr, and the larger Afon Gyrach, flowing down through the village of Dwygyfylchi. The two villages are separated by Foel Lus. The two main headlands are hard igneous intrusions with steeply sloping glacial fill valleys between. The two villages lie back from the shoreline on the higher slopes of the valleys. Along the frontage is a relatively wide intertidal sand beach backed by a shingle ridge. There is a narrow promenade at Penmaenmawr, with the Penmaenmawr slip road from the A55 at the western end and a sewage works towards the eastern end. There is limited access between the town and the promenade. The width between the backshore crest and the A55 and railway line, varies along the shoreline, with areas where defence is directly at the shoreline and areas where there is a wider upper beach and a narrow vegetated berm. This variation is as much a result of the variation in the coastline as in the alignment of the road and railway, with the road following through to and then setting back west of the low promontory at Foel Lus, crossing to the back of the railway alignment at this location

Outer Estuary - south

The two carriageways of the road divide at Pen-y-Clip and at Penmaen-bach, with the old road running around the edge of the headland. To the east, the coastal area widens into the outer estuary of the Conwy. The southern shoreline of the outer estuary, from Penmaen-bach, forms a sweeping bay through to the large sand feature of Conwy Morfa. The entrance to the inner estuary is relatively narrow and constrained between the Deganwy

headland on the eastern shore and the truncated Conwy Morfa to the west.

Across the outer part of the estuary there appears to be relic bar or ridge, possibly of glacial deposit, running through from the western side of Morfa Conwy to Tremlyd Point on the Llandudno shore. This bar forms the main mussel beds of the Conwy and associated with this are the purification tanks near the Fisheries Research Laboratory (no longer a functional unit) further within the inner estuary. There is archaeological interest in the form of fish weirs associated with the bar.

The bar partially blocks the north low water channel of the Conwy and the river has cut its main channel through in a westerly direction, offshore of Penmaen-bach. The bar also limits low water levels in the estuary itself.

The A55 and main railway run close behind the shore for a distance of about 500m just to the east of the Penmaen-bach headland. The routes then separate, with the railway running further in land over higher ground down in to Conwy and the road running more directly behind the area of Conwy Morfa. The road runs through the tunnel under the Conwy, rejoining the line of the railway just south of Llandudno Junction and then following the Mochdre valley through to Colwyn.

There is a large caravan park between the road and the dune shoreline of Morfa Conwy and then north of Merion Drive much of the Morfa is occupied by the Conwy Golf Links. Much of the dune face of Conwy Morfa is designated SSSI. To the rear of the dunes, and now being exposed by slow erosion of the shoreline, is an area of landfill.

Morfa Conwy

Inner Estuary - west

Just within the recurve of the Morfa, at the entrance to the inner estuary, is the major new development of the Conwy marina and associated housing. Between the A55 and the railway line is the more established development of Morfa Conwy and the newer industrial estate. Despite this development being in on relatively low lying land, this area is important to the town, as a whole, as being one of the few open spaces within which industry can be developed. This is, therefore, a significant area supporting the economic well being of the town.

Further within the inner estuary is the high ground of Bodlondeb Wood, forming a small headland. Upstream of here, between the headland and the old road, rail bridges and causeway, is the waterfront of the old town of Conwy. The old walled town and the castle are designated as a World Heritage Site and the town is one of the iconic images of Wales. Both the tubular railway bridge and the suspension bridge are Grade I listed structures and much of the water front property is also listed. The quay, and the quay just up stream of the bridge, is important for both recreational boating and for the small fishing fleet.

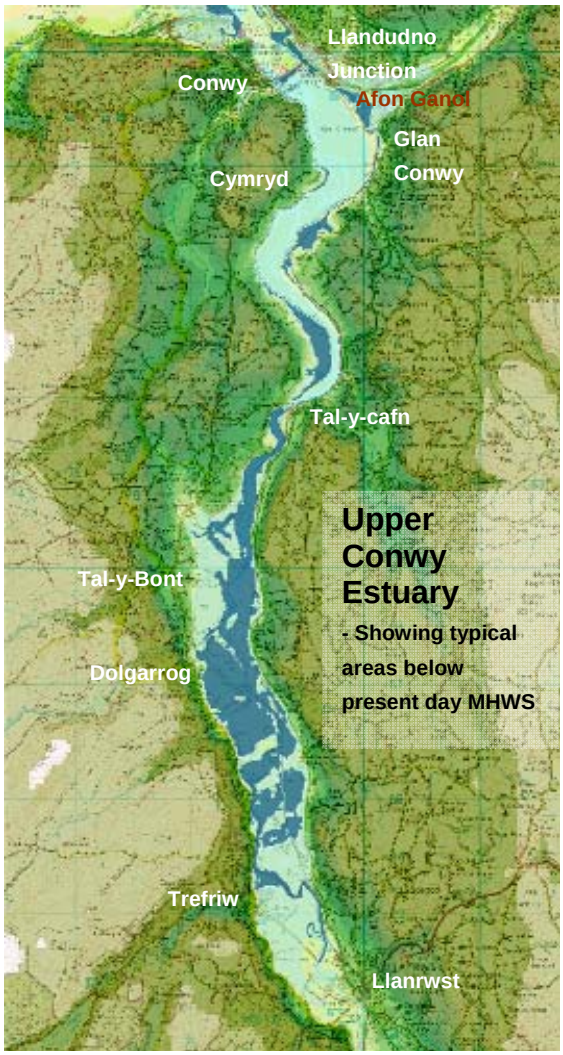
The strong flows in the Conwy are obviously channelled through beneath the bridges forcing the flood flow to the western side of the upper estuary against the rock of Benarth Hill. The areas both to north and south of the causeway on the eastern side have accreted as high intertidal mud flats in the lee of the causeway.

The valley of the Gyffin, just south of the town has important car parking, supporting tourism in the area and there are various properties and a school developed in the flood plain.

Upper Estuary

Across the causeway is Llandudno Junction, which has been developed as a significant commercial and residential area. Much of the commercial and industrial development, together with the main water works is situated within the low lying reclaimed land of the Afon Ganol Estuary. At the widest part of the mouth of the Ganol is the Glan Conwy Nature reserve. This is partly protected by a low embankment behind the mud flats in the lee of the causeway.

The affect of the accretion of mudflat is that main low water channel of the Afon Ganol effectively runs south against the ebb flow of the Conwy, south past the village of Glan Conwy, on the eastern side of the main upper estuary. Several streams are culverted through Glan Conwy and to the south of the village is the wider valley of the Nant Garreg-Ddu.



Much of Glan Conwy is on the higher sloping shoreline of the estuary. However, the lower lying industrial estate to the north is protected by the railway line running along the shoreline. There are local areas of rock outcrop to the shoreline and small areas of salt marsh in front of the defence.

The upper estuary narrows between the headland of Cymryd and Glan Conwy and takes the apparent form of a typical meandering funnel shaped estuary. However, much of this area is infilled with sediment and the main flow channels show strong flood and ebb preference across this in-filled plain. The shape of the larger valley is strongly determined by the harder geology. The main flood plain beyond the main width of the channel is agricultural land on either bank. The railway line runs down the eastern side of the estuary. Just south of Glan Conwy it crosses the flood plain, and is defended by intermittent structures. The main road down the valley, the A470, linking Betws-Y-Coed to the Conwy area and the coast, joins the railway at the edge of the estuary at Pont Furnace, where the Afon Hiraethlyn runs down through to the National Trust Bodnant Gardens. The road and railway continue along the edge of the estuary, through Tal-y-cafn and on to Llanrwst. The railway in places cuts across the lower valley floor.

On the western side, the main B 5106 stays mainly over the higher ground, only coming down close the valley floor at Tal-y-Bont, through Dolgarrog and Trefriw and then across the flood plain at the head of the estuary at Llanrwst. The road only locally drops below 6m OD and over most of its length is well above 7m OD.

At Tal-y-Cafn the estuary valley narrows through almost a gorge, before widening again into the flat bottomed sediment filled valley from Tal-y- Bont through to Llanrwst. Upstream of Tal-y-Cafn, low water levels are regulated by a rock outcrop/ledge. This valley floor is important improved grass land, with some areas of arable farm land. Between Tal-y-Cafn and Dolgarrog, where the Afon Porth-llwyd is canalised through to the channel of the Conwy, only the western side of the estuary valley is embanked. Up stream of here both sides of the valley are embanked, effectively canalising the channel of the Conwy through to Llanrwst. The Afon Ddu and the Afon Crafnant are similarly maintained between embankments.

All the main villages tend to be to the higher ground of the steeply rising slopes to the main valley. The sewage works at Tal-y-Bont and the factory at Dolgarrog, with its small quay, are on the valley floor.

There are important historic sites of the medieval Motte at Pont Tal-y-cafn and the Site of Aberconwy Abbey, at Maenan. There is also the Kanovium Roman Site just north of Tal-y-Bont. The whole valley constitutes an important tourist route with the gardens, its designation as an Historic Landscape Area and the historic villages of Llanrwst and Trefriw. The transport routes along the valley edge give access to the area and provide an important regional transport corridor. The whole valley from Dolgarrog and out into the inner and outer estuary is designated as a one large SSSI.

Inner Estuary - east

Returning to the eastern side of the inner estuary, north of the causeway, on the Llandudno Junction side of the inner Conwy estuary, there have been two major areas of reclamation over the foreshore: that associated with the A55 tunnel (dating from the 1990s) and, further north, the redevelopment of the old Deganwy Port as the Deganwy Marina and housing (dating from the late 19th century). The more recent Deganwy marina development dating from the early 2000s did not significantly change the footprint of the reclamation. The branch railway line and main road run just behind these areas through to Deganwy and Llandudno. The main town of Deganwy is developed further up the coastal slope, such that the road and railway almost define the limit of the tidal flood plain. At the mouth of the inner estuary, between the areas of reclamation and Deganwy Marina and the older housing on Deganwy Point, defence to

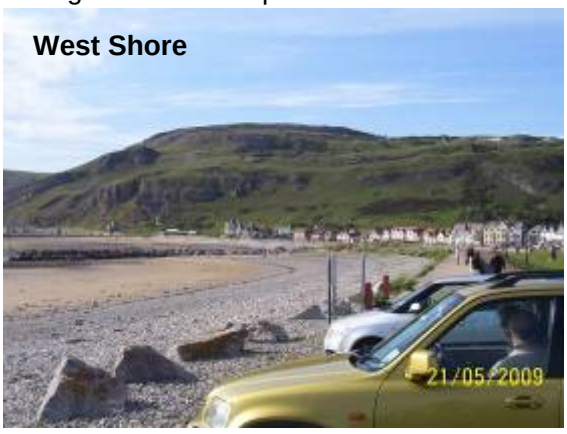
the railway line forms the backshore of the estuary.

Deganwy Point is an interestingly orientated shingle spit, presumably developed over more solid geology, running down from rocky hill (the Vardre), upon which sits the remains of Deganwy Castle (SAM). The Point has been built upon and is now defended with a sea wall behind a steep shingle beach.

Outer Estuary - east
North of the Point is Traeth Melyn bay, with the railway line running close behind. This bay with its wider, more gently shelving shingle foreshore, is more typically open coast than the shore to the south. It runs through to the start of the dune back foreshore of the North Wales Golf Course and to the southern end of Llandudno West Shore.

Just south of Tremlyd Point, south of the main West Shore frontage, is a significant low lying valley. This runs through the Golf Course and through to the more generally low lying basin occupied by the central development of Llandudno. The railway line, having turned inland just north of Deganwy, runs in part along this valley. The mouth of the valley is understood to have been infilled with rubble and this ridge forms one of the key defences to Llandudno.

There are three fishtail breakwaters along the West Shore frontage, retaining sediment to the foreshore. The most southerly breakwater is built out from Tremlyd Point. North of here is the relatively high dune to the northern end of the Golf Course. The beach to the north becomes progressively more shingly, as one moves from the areas of dunes through to the built up area of West Shore. At the southern end of this section there is a large car park providing important access to the recreational foreshore. Further north the defended backshore gives on to a wide grassed area, with the road and housing set back some 50m behind the defence. This open space tails out to the northern end at the start of Marine Drive, the road that runs around the Great Orme. The northern most breakwater is built out from the coast at this point. The two northern breakwaters have successfully trapped sand in their lee, but concern over wind blown sand has now been identified as a potentially significant issue by local residents during consultation. The popular beach at West Shore, however, offers a very different character to that of the predominantly shingle beach of North Shore and this, together with the open informal space of the promenade, is an essential aspect of both amenity and the tourism, underpinning the economy of Llandudno. All upper beaches between Deganwy and Gogarth have been artificially recharged. The beach between Gogarth and Tremlyd Point was recharged in 1991-92 as part of the coastal defence scheme that included the breakwaters. South of Tremlyd Point, the beach was recharged in 2006 to provide additional protection to the new cycle route which was constructed along the toe of the dunes in 2006.



West Shore

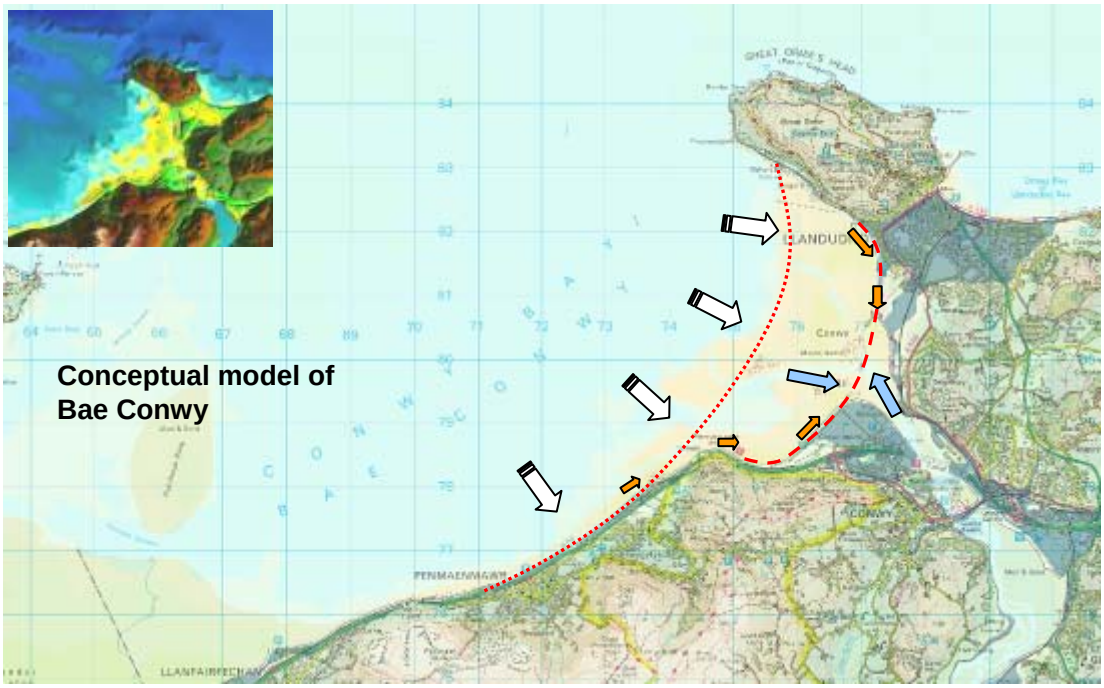
The northern breakwater also provides protection to the start of the road wall to the north, where the road starts to climb away from the foreshore around the Orme. Further north around the Great Orme, there is a row of some 30 properties at Gogarth, situated on the lower slope of the Orme. The road runs to the back of these properties. Central

to the row is the remains of the medieval Bishop's Place (Gogarth Grange, SAM), where there is on-going erosion. The properties are generally well set back from the rocky shingle foreshore and are protected by a variety of local defences. From here the zone runs out to the high cliff of the Great Orme Headland and the northern end of the SMP area.

2 Coastal Processes

The dominant wave direction is from the northwest through to north, the offshore area gaining significant shelter from Ynys Mon. Inshore, locally generated waves associated with the dominant south westerly wind can be significant, although such waves are more tidally limited to periods of high water when the full fetch through to the Menai Strait is developed.

Waves entering the main bay are further constrained by the Ynys Mon, Penmon Peninsula and by the shelter afforded by the Great Orme. As such the net wave energy around the shoreline typically tends to spread in from the northwest, over the southern section, to more westerly in the shelter of the Great Orme in the north. The area occupied by Llandudno is in effect a tombola of sediment formed behind the headland of the Great Orme, between the headland and the mainland. However, such a simple description tends to ignore that, to the south, the outer estuary also acts as an open bay, linking between the Great Orme and the headlands of Penmaen Mawr and Penmaen-bach. This is bay is illustrated in the conceptual model of the area shown below. It should be noted that the detailed process are considerably more complex than shown in the illustration. However, it does provide a basic concept from which to discuss the local processes.



At the larger scale, the area can be seen as a large bay formed between Penmaen Mawr (Pen-y-Clip) and the Great Orme. This effectively forms the low water shape of the area with a sediment slope against which larger waves are working. To the north, one might expect some drift to the south over the low water area and this is reflected in the way in which the southern channel of the Conwy forms a spit in a southwesterly direction. It also suggests an under lying interaction between sediment movement within the whole bay, being generally pushed into the larger bay, forming the low intertidal sand bank against the ridge of harder geology across the mouth of the Conwy and being redistributed by the ebb flow of the Conwy estuary. Conwy Morfa, the ridge across the mouth of the estuary and the shoreline from Tremlyd Point to the Orme, effectively form an upper bay.

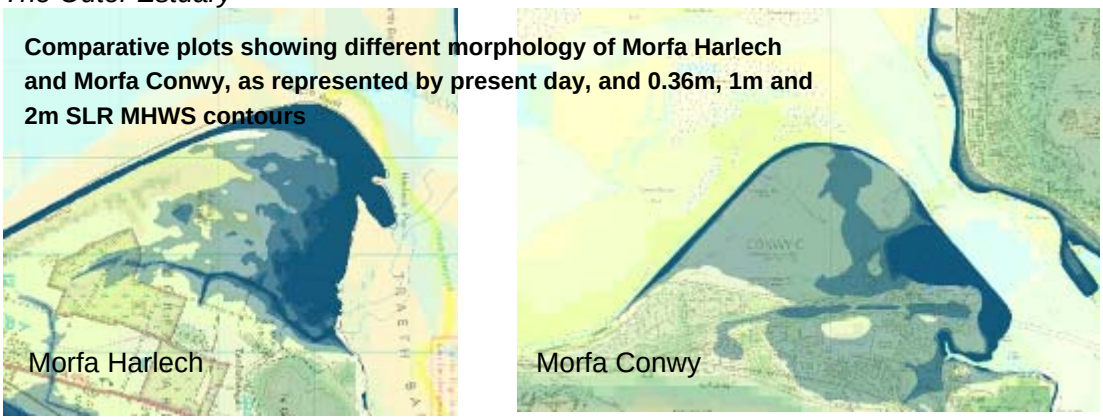
The Southern Shoreline

The southern shoreline in the Penmaenmawr (Pen-y-Clip) area forms the immediate backshore to the larger general bay shape in this area. This shoreline is dependant to a degree on the recycling of sediment by estuary flows. However, on the whole, this section is seen as being relatively independent of the main outer estuary system. The western face of Penmaen Mawr, in front of Garizim, stands proud of the general alignment of the shore and is exposed to the main wave energy. It is orientated such that net sediment drift will tend to be weakly to the west but this drift would be critically affected by small changes in day to day wave direction, with the potential for drift either to the east or west.

This hard defended frontage of Garizim acts as the main headland to the coast to the east. The ability for the softer shoreline, to the east of this headland, to have eroded back, provides the critical width for development of the narrow backshore beach. The variation in the width of the beach is created both artificially by the defence at the A55 slip road and more naturally where the underlying ridge of Foel Lus drops to the shore, (now reinforced by the A55 revetment). Further variation in width is seen in front of Alt Wen, where there appears to be harder foreshore and where the sewage works is built out on a natural backshore platform. This all indicates the relative stability of the current alignment. Clearly, with sea level rise this alignment would want to set back, but the areas of defence and the areas of beach retention give a degree of sustainability to the frontage, at least over the medium term, making the local headlands important in management of the frontage.

At Penmaen-bach, the headland is seen as being slightly behind the line of the coast to the west, reflecting again the significance of the slight raised foreshore at Alt Wen. There is likely to be some drift from the northern section of the Penmaenmawr/ Dwygyfylchi frontage to the east. This is noted in the development of a low intertidal bank, almost as a banner bank attached to the headland and potentially results from accelerating flood flows into the Conwy, as much as by wave driven drift along the shoreline from the west.

The Outer Estuary



Comparative plots showing different morphology of Morfa Harlech and Morfa Conwy, as represented by present day, and 0.36m, 1m and 2m SLR MHWS contours

Penmaen-bach forms the main southern headland of the upper tidal backshore system, forming a sweeping bay along the underlying ridge through to Tremlyd Point and West Shore to the north. Morfa Conwy is seen far more as an open coast backshore feature (a morfa), rather than as a traditional estuary spit. This difference is highlighted by comparison, below, between the ridged morphology of a classic ridged spit, such as that seen at the northern end of Morfa Harlech, compared to the more uniform structure of Morfa Conwy. The recurved spit of Morfa Conwy is at its northern end, forming in towards the inner estuary. With erosion of the head of Morfa Conwy, this local spit

feature has in effect been breached, no longer providing a continuous ridge as protection against flooding.

The significance of this morphological distinction is in the anticipated drift along the dune of Morfa Conwy. This frontage is functioning far more as a slowly eroding backshore, with only relatively weak drift to the north. The northern end of the morfa is acting more as a soft retreating headland. Sediment moving north gets carried in to the inner estuary. Any attempted growth of the recurved spit is severely constrained by the width of the estuary mouth, with sediment then carried into the estuary on the flood, but as identified in appendix C, more typically out of the estuary on the ebb. This process, limiting growth of the Morfa Conwy frontage across the mouth of the estuary would support the concept that the estuary is in a relative fine balance of equilibrium. There are therefore potential management issues interacting between the Morfa Conwy side of the estuary and the Deganwy side, where Deganwy Point is seen as the more dominant control of the estuary mouth. There are also potential issues with respect to sea level rise and to a lesser degree due to a possible increase in tidal prism, if defences within the estuary were removed.

Along the northern shoreline of the outer estuary the glacial deposit to the base slopes of the Great Orme has been a contributor to sediment into the system. These coastal slopes are at present relatively stable and much of this supply will have been taken out of the process. Drift along the Gogarth frontage will be towards Llandudno West Shore. Prior to construction of the fishtail breakwaters there was a relatively rapidly dropping foreshore in front of the sea wall. The breakwaters and subsequent recharge have slowed this process, although it is reported that the lower foreshore has continued to reduce in level. This would need to be monitored, given the harder substrate evident at the heads of the breakwaters.

With the breakwaters in place, the shoreline has adapted to a relatively stable orientation. The backshore in the centre of the frontage between the north and central breakwater is still in advance of the fully developed bay shape, but is capable of retaining a good width of shingle beach.

South of the southern breakwater, there is a relatively stable width of shingle in front of the old stone filled timber breastwork, with little evidence of a strong drift system. This is similar along the Traeth Melyn frontage, although here there is very obviously stronger tidal flow influence and harder underlying material over the narrow foreshore. This returns to Deganwy Point at the mouth of the inner estuary, where there has been obvious accretion to the northern face of the point but the more southwesterly facing frontage is clearly swept by both tide and waves entering the inner estuary.

With sea level rise the whole outer estuary backshore system is going to want to roll back. Where constrained, this could lead to increased drift towards the Conwy or draw

down of the backshore beaches. Any coarse sediment (sand and shingle) brought into the mouth of the estuary is likely be taken out again with the ebb flow. How the actual channel positions and how the nearshore intertidal banks will adapt is uncertain. If the main estuary ebb channel is constrained by the harder ridge running across the estuary at present, any such constraint would reduce as water levels rise. This could give rise to a more direct channel to the north. However, if the nearshore banks are in some manner formed against the harder ridge then increased water levels could result in the banks potentially moving inshore, potentially proving greater sediment supply to the backshore area.

The Inner and Upper Estuary

With sea level rise there will be some increase in tidal prism within the inner and upper estuary. This would tend to widen the estuary mouth, putting greater pressure on Deganwy Point and on the north and east facing edges of Morfa Conwy.

With tidal processes dominating within the inner estuary, it is the constraint imposed by the causeway which dominates the processes of the inner estuary. The main channel is maintained to the western banks and this has allowed accretion of the mud flats to the west. The same may be said of the start of the upper estuary upstream of the bridges.

In general, up stream, there is sufficient width within the valley floor to accommodate change and meandering of the main channel position. Where there is constraint, this is typically where flow is against harder sections of the shoreline. There is a natural constriction at Tal-y-cafn and, down stream, of this point there is more evident balance between flood and ebb dominant features, in terms of banks and channels. However, even some way upstream at Tal-y-Bont there is still quite significant sediment features that demonstrate the degree to which flood flow still influences the geomorphology and sediment processes.

From Tal-y-Bont upstream there are significant areas of the valley floor which are below present day MHWS level

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. This is also discussed briefly following the table.

Location	NAI Base Rate (m/yr)	Notes	100yr. Erosion range (m)
Garizim	0.2	Roll back, following failure of defences, with SLR	20 - 70
Penmaenmawr	0.2 -0.3	Roll back, following failure of defences, with SLR	20 - 100
Morfa Conwy	0.3 – 0.7	Readjustment of alignment and roll back with SLR	50 - 170
Deganwy	0.1 – 0.3	Erosion and roll back following failure of defences with SLR	15 - 75
Traeth Melyn	0.1	Roll back, following failure of defences, with SLR	15 - 50
Llandudno WS	0 – 0.3	Held by breakwaters with roll back of dunes with SLR	15 - 100
Gogarth	0.1	Natural cliffed frontage with potential landslips	10 - 80

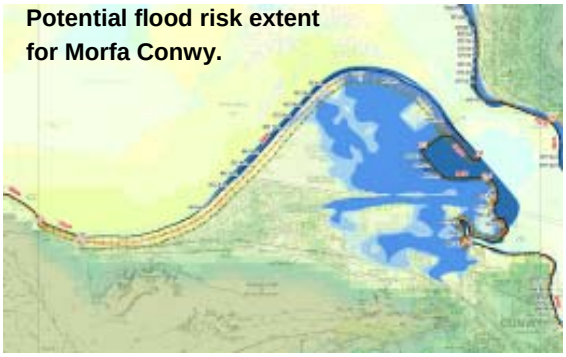
Base rates have been assessed from monitoring and historical data. The range of potential erosion is assessed in terms of variation from the base rate and sensitivity in potential sea level rise. Further detail on erosion rates together with erosion maps are provided in Appendix C.

FLOODING

There is only very local and minor flood risk to areas along the Penmaenmawr frontage:

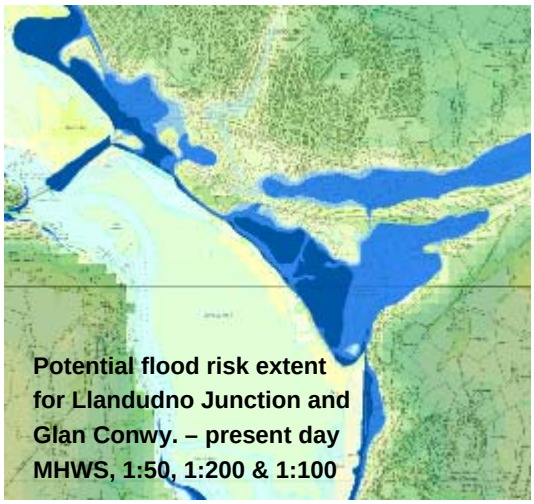
- along the promenade, where wave overtopping would increase substantially with sea level rise,
- in the mouth of the Afon Gyrach and at the small stream just north of the sewage works. The Gyrach and the stream are each culverted beneath the main transport routes and as such flood would not impact on these routes.

Far more significant is the potential flood risk in the area of Conwy Morfa. This is shown in the following plot for flood risk under MHWS, 1:50 year, 1:200 year and 1:1000 year water levels. This may be compared to the potential extent of MHWS flooding levels with sea level rise presented earlier. The area south of the A55 is protected to a standard of 1:100 years, with the road and tunnel protected to a much higher level. However, the plot also highlights potential erosion and the risk that breach in the northerly line of defence could significantly impact on areas around the Marina.

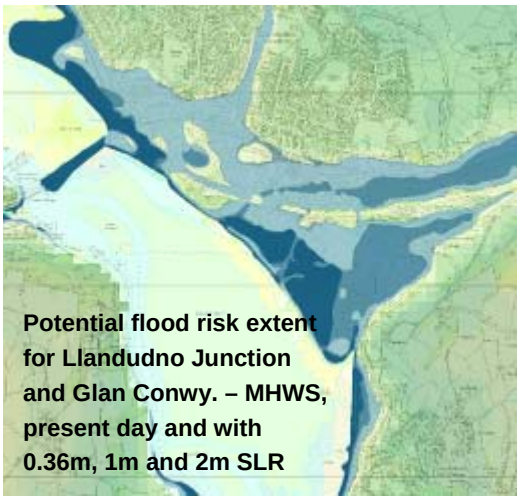


Potential flood risk extent for Morfa Conwy.

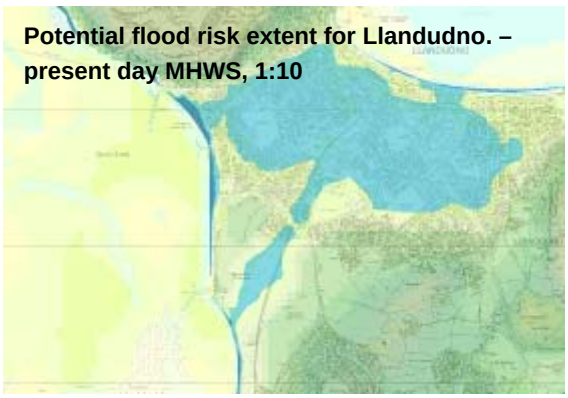
At Llandudno Junction and Glan Conwy it may be seen in the following plots, below, that a major part of the town centre and commercial and industrial estates lie within the flood plain. The second plot highlights the impact of sea level rise, demonstrating that much of the area could be affected on a regular tidal basis.



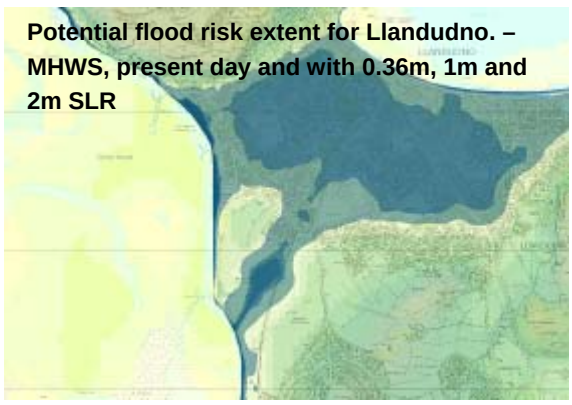
Potential flood risk extent for Llandudno Junction and Glan Conwy. – present day MHWS, 1:50, 1:200 & 1:100



Potential flood risk extent for Llandudno Junction and Glan Conwy. – MHWS, present day and with 0.36m, 1m and 2m SLR



Potential flood risk extent for Llandudno. – present day MHWS, 1:10



Potential flood risk extent for Llandudno. – MHWS, present day and with 0.36m, 1m and 2m SLR

At Llandudno, a substantial area of the town, in excess of 4000 properties, including the main commercial centres of the town, lie within an area below the 1 in 10 year extreme water level. This is, at present, defended from direct flooding from the sea. The defences at North Shore and West Shore provide defences to a 1 in 100 year level. The area is shown on the plot above, highlighting the main flood routes, including that across the Golf Course to the south. With sea level rise, shown in the second plot, the potential areas of risk are shown to increase, with much of the centre of the town being below MHWS under a 1m sea level rise scenario.

Impact of different Sea Level Rise Scenarios

Under a 2m sea level rise scenario, the area of Llandudno situated below MHWS would increase, with much of both sea fronts being below the level of normal high water.

The Conwy and Clwyd Catchment Flood Management Plan (CFMP) Draft Plan, recognises this: *Llandudno shows a high number of people at risk from the 0.1% AEP flood map. However, this high risk is caused by sea flooding directly from the coast. This flood mechanism is covered by the SMP.* It is also noted that there was severe local flooding during the 1970s. This was caused by surface water drainage issues but exacerbated by tidal locking of the drainage system. Areas of the town now rely on a pumped drainage system to alleviate local flooding.

The CFMP also discusses flooding within the Conwy Valley.
For modelling the future risk a similar approach was taken to modelling the current risk with flood defences assumed to be at existing levels. For the Conwy Valley predicted tide levels for the range of return periods were simply projected upstream since no model was available to accurately model flooding within the Conwy estuary. This method assumes wholesale failure of the earth embankment flood defences. For the River Ganol area overtopping was assumed to occur and a subsequent breach in the defence was modelled for the 10%, 0.5% and 0.1% tidally influenced fluvial events. The resulting flood outlines for the Conwy estuary are shown in the CFMP. A comparison of the predicted future flood extents with the equivalent, predicted current extents suggests that, in future, tidally influenced flooding is likely to extend further up the Conwy Valley towards Llanrwst. Estuary defences at Llandudno Junction would be sufficient to defend against the MHWS tide level. However, higher tides would be likely to overtop the defences leading to increased likelihood of breaching which could cause subsequent flooding along the River Ganol as far as Penrhyn Bay.

The model simulations at Trefriw for the combined probability analysis produced risks that were comparable to but no worse than the fluvial only event. However, further down the valley close to Dolgarrog the tide level begins to dominate the flooding and flood risk is consequently more severe. The study served to demonstrate that the higher reaches of the River Conwy, close to Trefriw, are not very sensitive to changing joint probability combinations of tide levels and fluvial flows. The most extreme conditions tend to come from either high river flows and low tide levels or from low river flows and extreme tide surge effects.

The predicted extreme sea levels with climate change indicate that the current earth embankment defences in the Conwy valley would be overtopped by the future predicted MHWS level and all higher flood events. The CFMP also notes that under these circumstances, it would be impractical to retain the defences in their current form owing to the increased future likelihood of frequent breaching of these defences

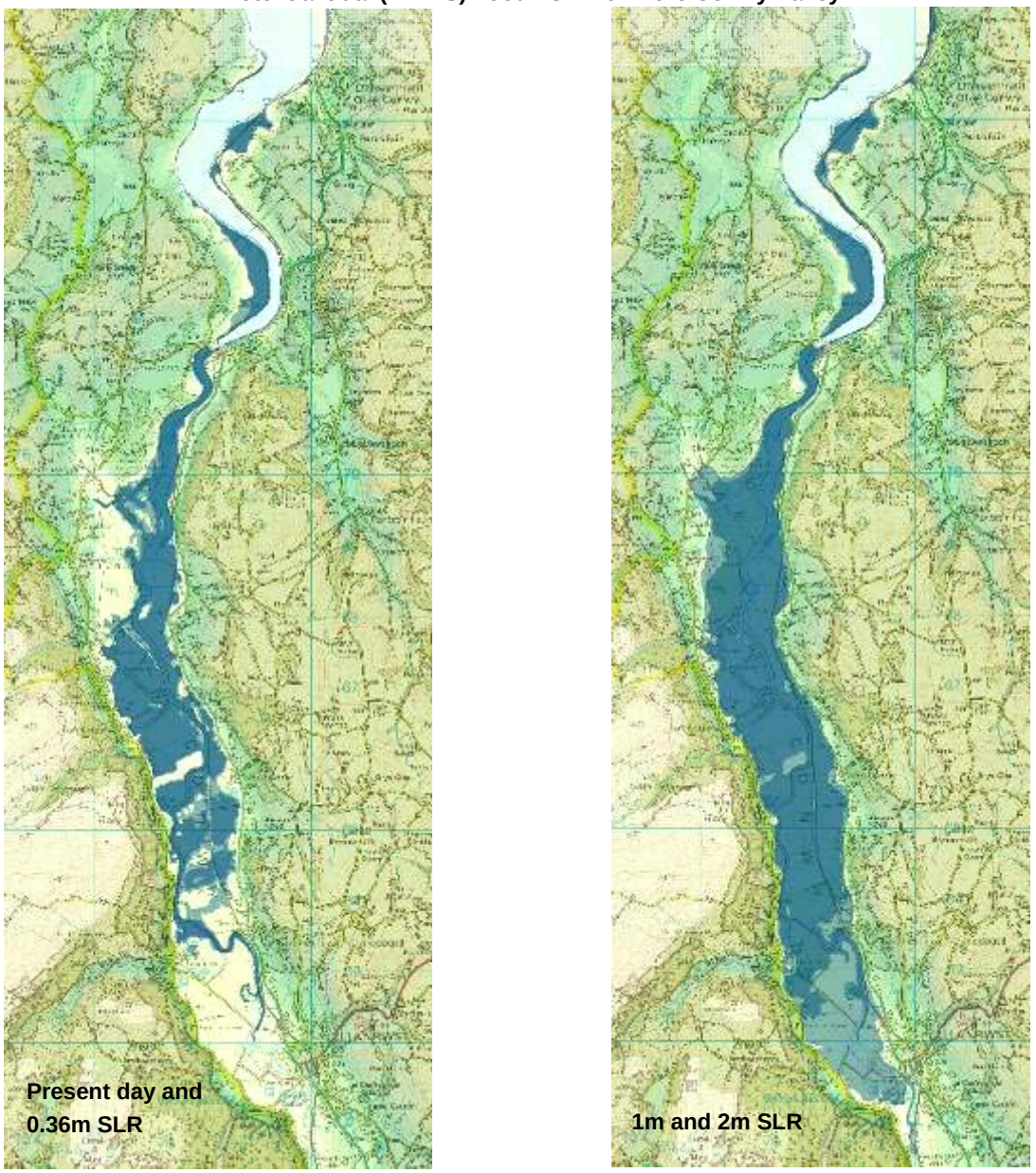
The defended agricultural land in the Conwy Valley has reduced the floodplain storage capacity for more frequent storm events and has also resulted in the loss of wetland

habitats. The loss of floodplain storage has increased the flood risk to Llanrwst and Trefriw. Part of this problem is being addressed by the recent flood defence scheme in the Conwy Valley under the Conwy Valley Strategy.

The tidal flood extent under different sea level scenarios is shown on the two plots, below, using the same approach taken by the CFMP of projecting coastal water levels over the area, up the Conwy. The plots show potential flood extent for MHWS under present day conditions and 0.36m SLR (nominal 50 years) and MHWS under a 1m (nominal 100 years) and more extreme 2m SLR scenario. Under the 1m sea level rise scenario much of the upper estuary would be within the natural tidal flood risk plain with potential tidal locking to the main tributaries.

Impact of different Sea Level Rise Scenarios
Under a 2m sea level rise scenario, the normal tidal flood plain would extend up stream to Llanrwst.

Potential tidal (MHWS) flood risk within the Conwy Valley



EXISTING DEFENCES

There are defences along much of the Garizim and Penmaenmawr frontages, particularly associated with the defence of the railway and the A55. Where there are no defences, typically this is where there is natural rock. The railway defences are generally old with the original walls across Pen-y-Clip dating from the mid 19th century. These have been extended as beach levels dropped and recently new toe works have been installed. The rock armour defences to the A55 date from the 1990s. The condition of the defences is variable. East of Penmaen, the railway is defended by a vertical wall for a length of some 500m, before giving way to the locally managed dune frontage of Morfa Conwy. Here the varied defence of timber and rock works are in poor condition and there are areas of erosion to the dune face. The dunes are badly trampled, reducing their capacity as a natural flood defence.

On the inner estuary face to Morfa Conwy there is a major new rock defence to the marina. There are also local defences in the area of the A55 tunnel.

Further upstream there are only local defences through to the main water front of the town, built on a rock outcrop. Here the defence is the quay. Both faces of the causeway are defended with a light revetment facing upstream and the vertical wall on the down stream side. On the western side of the inner estuary there are a variety of defences including that to the western tunnel entrance, the harder defence at Deganwy Marina and the sea wall to the railway line. At Deganwy Point there is a relatively high crest flood wall above the shingle bank and to the north of here an old vertical crest wall to the back of Traeth Melyn.

The old rock filled timber defence south of Tremlyd Point is largely buried at the crest of the shingle beach by artificial quarried recharge. To the north are the fishtail breakwaters discussed earlier, which maintain beaches in front of the old stepped sea wall to West Shore and beyond that are the various sections of concrete wall to the road and the private defences at Gogarth.

Upstream of the causeway are the flood defences to the nature reserve and, behind these, the defence to Llandudno Junction and the Afon Ganol. Further south is the low defence to the railway line, providing protection to Glan Conwy. Within the upper estuary generally there are various defences to the railway line on the western side and local defences to agricultural land on the east. There are also some low defences to property at Tal-y-cafn. Upstream of Tal-y-cafn there are defences to the western side to low lying agricultural land initially, but further within the estuary each of the rivers, including the Conwy are embanked with much of the land behind the defences below MHWS. Defences are understood to provide a defence standard to typically a 1 in 10 year level of defence. The railway line runs through areas of the flood plain to the western side of the estuary. This provides some additional defence to part of the flood plain but only to the same sort of standard and would, therefore, not be that significant in terms of tidal flood defence.

With the exception of Llandudno, and locally at Llandudno Junction, where there is pumped drainage, all fluvial and surface water drainage is sluiced by gravity (i.e. water is allowed to flow from these areas over the lower tidal periods.)

UNCONSTRAINED SCENARIO

In the absence of defences, erosion would occur along much of the frontage. In particular the shoreline at Penmaenmawr would set back and continue to erode slowly into the valley between the two headlands. This would provide width for development of a wider beach area, but with the obvious loss of the A55 and railway line.

Principally, with sea level rise, the Morfa Conwy frontage would erode back. This would provide additional sediment into the system as the whole frontage develops back. The dominant flow regime across the head of the morfa is seen as being on the flood. Therefore, it is probable that sediment would not be held at the head of the morfa. The main risk would be in terms of flooding as the head becomes thinner.

Within the inner estuary and up stream there would be very substantial changes, in that, in the absence of the causeway the whole estuary would develop more naturally. The Ganol estuary would function more naturally with the loss of the mud flats and the potentially greater flood plain of the whole side estuary would increase. Within the upper estuary the tidal area is likely to reform as salt marsh and it is probable that the area would accrete with sea level rise.

Along the Deganwy frontage there would be slightly greater erosion, responding to the natural movement re-established in the Conwy.

The Llandudno area would develop further as a tombola, with an input of sediment behind the Orme and as this occurs, it might be seen that the main ridge of the tombola would develop more on the western side, with the main northern area of Llandudno becoming a marshy bay to the northern side, backed by a higher sandy dune to the west.

KEY INTERACTION WITH DEFENCES

Apart from the obvious fact that defences stop erosion and roll back of the various frontages, it is only the causeway (not a formal coastal defence structure) that is imposing a fundamental role in modifying the way in which the natural system performs.

Clearly such defences as the three large breakwaters at West Shore impact of the behaviour of the beach, but this impact is seen as relatively local.

The embankments potentially reduce the tidal prism of the upper estuary, but even here this is seen as a secondary effect compared to the influence the causeway has had on the inner estuary.

3 Management Scenarios

3.1 No Active Intervention – Baseline Scenario 1.

As can be seen from the summary tables, and with reference to the flood risk plots provided earlier, the largest obvious impact on the whole area would be that of flooding. Under this scenario, the approach to this would be to undertake no further work to sustain or maintain defences. This obviously recognises the extreme impact this could have on major areas, as is considered quite specifically to identify this.

No Active Intervention scenario is discussed first in terms, therefore, of the main flood risk areas. It is taken that, even under such this scenario, the causeway across the inner estuary would remain. There would, with sea level rise, be increased flooding to the promenade area of the causeway and eventual failure of the defences. However, it would still act as a barrier and, as such, it would still constrain the behaviour of the estuary.

Based on this, at Conwy, the main impact would be in relation to Morfa Conwy and the area immediately behind. Over the first epoch there would continue to be damage to the dune frontage. Under extreme conditions this could result in a breach at the northern end of the Morfa. This would not be repaired and it would, in effect, separate off the spit head that recurves around into the estuary. As sea level rise develops, the area of the Golf Course would revert to saltmarsh. This would increase flood risk behind the marina and, in the long term, substantially increase risk of flooding to the A55 tunnel. The area to the south of the A55 would also become more exposed to flooding and in addition to the eventual loss of the main transport route, would, potentially during epoch 3, result in the loss of the important commercial and industrial estate area of Conwy. Because of the topography of the general area it would be difficult to find land for relocating this important element of the local economy. The loss of the marina would similarly result in significant economic impact, beyond merely its intrinsic value.

It is unlikely, however, that the course of the river would change, although there could eventually be some widening of the river mouth. Given the harder nature of the Deganwy shoreline, this would tend to widen on the Conwy side. These changes would all have significant economic impact and loss if vital tourism, as well as threatening continued use of the main A55. There would be some ecological benefit in terms of saltmarsh development but this at the expense of loss of the designated area of the dunes.

Along the actual Conwy frontage, there would some increased risk of flooding to the properties at the quay, and this would be associated with the failure of the quay itself. There would be flooding on the Afon Gyffin to the south of the town. Even with 1m sea level rise the extent of flooding would only be quite limited, to the narrow valley area beneath the main walls. It would however increase the risk to the school buildings.

Impact of different Sea Level Rise Scenarios

Under a 2m sea level rise scenario, the normal tidal flood plain would occupy much of the low land up the valley of the Gyffin. The school would be at significantly greater risk, as might properties at the bridge within the village of Gyffin.

In the area of Llandudno Junction and Glan Conwy, while the defence to the A55, would provide longer term protection to areas to the north, there would be substantial increased flood risk to the Ganol valley. The area north of the railway line, the main industrial estate and residential properties, would become increasingly tidally locked with further flood risk from surface water. The CFMP also identifies that tidal locking could impact on a larger extent of the Ganol valley. As defences fail and as sluices are not maintained and with only minor sea level rise over the first 2 epochs, tidal flooding would occur to much of the core commercial area of Llandudno Junction. At Glan Conwy there would be loss of the railway line as defences become overtopped and there would be substantial damage to the business park and the station.

Impact of different Sea Level Rise Scenarios

Under the 2m sea level rise scenario, the whole area described above would be below MHWS, including Llandudno Junction Station. Defences to the A55 tunnel would in all probability have been breached during epoch 3 due to regular overtopping and the main transport routes would be lost. There is the potential, on extreme events, for flooding to occur over much of the Ganol Valley up to Mochdre and potentially through to Penrhyn Bay.

The impact on the area would be immense. Much of the core economic infrastructure would be lost, including the transport routes to the Menai economic hub, the rail service up the Conwy Valley and north to Llandudno. This would have exceptional regional consequences.

Along the Deganwy shoreline, there would be gradual deterioration in defences, with increased flood risk to the new marina area. It is assumed that new property in the local area would have been designed to allow for sea level rise, however, there would be substantial increased flood risk to the main access both locally and more generally in terms of the railway line and the coastal road.

Impact of different Sea Level Rise Scenarios

Under the 2m sea level rise scenario, the coastal road and railway line would be below the level of MHWS, with some areas being subject to flooding on normal tides within the next 60 years.

The properties at Deganwy Point would be subject to regular flooding as defences become more regularly overtopped during epoch 2. The general increased flow within the Conwy, over epoch 3, is likely to result in increased erosion of the point, which would result in the potential for erosion loss to properties. It would also mean that any residual flood defence to the area was lost. The railway line might, in effect, be the new shoreline, although this would be flooded further south.

Continued erosion along the Traeth Melyn area, through to Tremlyd Point, would open the southern flood route through to Llandudno, potentially creating a new small tidal inlet in this area in the longer term. This might be closed as sediment accumulates within the deeper recessed bay created. As the breakwater at Tremlyd Point becomes less effective, (possibly this structure would still act as a significant headland through into epoch 3) and as sea level rise increases, the balance between a more sustained tidal inlet and a self sustaining dune system might become more tenuous.

Clearly as the defences along West Shore are more regularly overtopped and as the breakwaters become less effective the risk of flooding and beach loss in front of the shoreline would eventually result in the loss of the old sea wall and regular flooding through to the centre of the town. Under this scenario, there would also be a No Active Intervention policy at North Shore. The combined affect would be the loss or abandonment of the town by the end of epoch 2.

Over the main built up area of the zone, as this pattern of defence failure and increased flooding occurs, so there would be potential for significant new areas of habitat to develop. However, in reality this would be severely mitigated by the built, commercial and industrial heritage of the area. There are specific areas of potential contamination, in areas such as the landfill site at Morfa Conwy and particularly in the areas of Llandudno Junction, Deganwy and Llandudno and there would also be significant more general risk in this regard. From this perspective, it could not be concluded that there would be substantial benefit from a nature conservation perspective. Quite obviously,

there would be significant loss in terms of the existing built landscape values and even in terms of the natural landscape.

This is not to say that on a more local scale there could not be benefits in terms of nature conservation. Within the Gyffin valley and with respect to the nature reserve at Llandudno Junction, restoring these areas to a more natural condition could be beneficial.

Within the upper estuary, as identified in the CFMP, defences, without maintenance following flood events, would fail potentially during epoch 2, even under present sea levels. With sea level rise, the main defences would be overtopped possibly annually by the end of epoch 2 and on most spring tides by the end of epoch 3. In effect, under this scenario, defences would be likely to fail early in epoch 2.

The failure of defences would not substantially increase flood risk to the principle villages within epoch 2. However, neither would this address the issue of tidal locking. During epoch 3, tidal locking may become more significant, although the CFMP suggests that at Trefriw there is both a fluvial and tidal risk and that, with sea level rise, there is as great a risk from fluvial flow and low tidal levels as there is between high tidal water levels and low river flow. This would suggest, under this scenario, where neither risk is managed, as sea level rises, the risk of flooding would substantially increase. This would only impact on a small number of properties, however.

Lower down the valley, at Dolgarrog, the aluminium works is already in an area below the level of MHWS. Under this scenario both the frequency of flooding and the extent of flooding would increase significantly.

On the western side of the estuary, approximately some 3km of railway line lies within the present day MHWS flood area. This length would increase to some 6km on MHWS with a 1m sea level rise. The frequency of flooding, overtopping of the embankment and consequential washout would result in loss of the railway.

Impact of different Sea Level Rise Scenarios

Under the 2m sea level rise scenario, annual overtopping of the main upstream banks could be occurring well within epoch 2 and on normal spring tides by year 75. Spring tide flooding would occur to the sewage works at Trefriw by the middle of the third epoch, and by the end of the first epoch the sewage works at Tal-y-Bont and Trefriw would be lost, together with the water works and aluminium works at Dolgarrog and property around Glyn farm at Trefriw. In addition there would be more generally flooding over the valley floor. Virtually the full length (some 8km) of the railway line between Tal-y-caln and Llanrwst would be below normal high water.

While there is an incremental step in the extent of flooding between the present day MHWS and MHWS for a 1m SLR, and then 2m SLR, there would then be little further increase in area on more extreme events under the 2m SLR scenario. There is a clear boundary of flooding defined by the more steeply rising sides of the valley, beyond the sediment in-filled valley floor.

The flooding that would occur within the upper valley has significant potential to both restore the function of the natural water course and enhance nature conservation values.

While flooding is the most obvious impact, erosion and change in the behaviour of the coast would be significant as well. Defence may fail along much of the Penmaenmawr frontage during epoch 2. This would be a function of the increased overtopping and scour, more than just deterioration due to lack of maintenance. The revetment along the Garizim frontage might also fail as larger waves impact on the frontage over epoch 2 or 3. This gradual failure of defences would result in significant erosion, with loss initially of the promenade and the sewage works and the A55 and railway line.

At Morfa Conwy there could be potential 100m erosion along the frontage, opening up the potential flood routes as discussed above, but also exposing much of the landfill site. There would be some increased erosion at the marina and this exposing the defence and the breakwater could, without response, result in loss of the marina area over epoch 3.

Although failure of defence within the inner and upper estuary may give rise to increased flooding, erosion in general is not seen as a major issue within the estuary apart from at Deganwy and Deganwy Point. There would be locally significant erosion in terms of where defences are retaining land behind; such as at Conwy Quay and at the new entrance to the A55 tunnel.

There would be significant erosion north of Deganwy Point and, while directly affecting the Golf Course, would be most significant in relation to the potential flood route that is likely to open through to Llandudno. The ability for the coast to set back, both here and at West Shore, would provide some additional width within which a more sustainable beach could develop. This would rely critically on the continued effectiveness of the breakwaters, which could still influence the coast over the next 75 years. When these structures fail or when they lose their influence on the shoreline behaviour, then erosion and set back of the shore would accelerate.

Along Gogarth, direct erosion is only likely to impact on the gardens of the various property. This could however trigger land instability which might impact on property over the period of the SMP.

3.2 With Present Management – Baseline Scenario 2.

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

SMP 1 No.	Unit	Policy	Ch.	Subsequent Management Approach
Gwynedd/Ynys Mon				
6.3	Llanfairfechan to Pen-y-clip	HTL/MR		
6.4	Pen-y-clip to Penmaen bach	HTL		
Conwy				
7.1	Conwy Morfa	SHTL		
7.2	Deganwy Narrows to Conwy bridge (both sides)	HTL		
7.3	Conwy bridge to Glan Conwy (both sides)	HTL/DN		
7.4	Glan Conwy to Tal-y-Cafn(both sides)	HTL/DN		
7.5	Deganwy Narrows to Gogarth	HTL		

SMP 1 No.	Unit	Policy	Ch.	Subsequent Management Approach
7.6	Great Orme (west face)	DN		

The following information is taken from the Conwy and Clwyd Catchment Flood Management Plan (CFMP) Draft Plan.

Policy Unit 2: Llanrwst and Trefriw

Policy selected: P4 – Take further action to sustain the current level of flood risk into the future. This is based on the overriding fluvial risk.

Implementing a Policy 4 in the Llanrwst and Trefriw policy unit will allow an optimisation of loss caused by flood damage and expenditure. With a Policy 4, based on our current knowledge, the future damages for the 1% event will be approximately £5.4 million and the AAD will be approximately £430,000. The policy choice is determined by the overriding fluvial risk. However, this policy would allow the tidally influenced flood risk at Trefriw to be tackled by either local defences or local flood resilience.

Policy Unit 3: Conwy, Llandudno, Llandudno Junction and Mochdre

Policy selected: P4 – Take further action to sustain the current level of flood risk into the future. This is based on the overriding higher tidally influenced flood risk.

If we maintain our current level of flood risk management into the future the 1% flood would cause an estimated £34.8 million property damages and impact 925 properties. The future AAD would be £158,000. This is a very high increase in risk. By implementing a Policy 4 in this policy unit, based on our current knowledge, the future damages for the 1% event will be approximately £15.5 million and the AAD will be approximately £1.1 million. We will investigate the need to increase the standard of the tidally influenced flood defences at the mouth of the River Ganol.

Policy Unit 4: Conwy Valley

Policy selected: P2 – Reduce current levels of flood risk management

By implementing a Policy 2 in this policy unit, based on our current knowledge, the future damages for the 1% event will be approximately £6.1 million and the AAD will be approximately £63,000. The affected properties are scattered throughout the policy unit and approximately 155 properties will be at risk of fluvial flooding. Options for reducing flood risk may include local flood resilience. The frequency of flooding to agricultural land will increase.

Summarising these two policy documents in defining the With Present Management Scenario:

- Along the southern section of shoreline, the approach would be to maintain and improve defence in line with sea level rise.
- At Conwy Morfa the approach is to locally hold areas of defence such as at to the road but still to maintain and improve flood defences.
- Within the inner estuary the intent from the CFMP would be to raise sea defence levels in the areas of Llandudno Junction and, from the SMP1, to maintain and improve defences generally throughout the area.
- The SMP only covers the upper estuary as far as Tal-y-Cafn, with a policy to maintain defences but then to potentially abandon defence in the long term.
- In the upper estuary, beyond Tal-y-Cafn, the intent of the CFMP is to sustain and improve defence against fluvial flooding but to take a more local approach with respect to tidal flooding to the villages. At the same time the intent would be to withdraw from physical defence of the main area of the valley

The implications of this are considered below, discussed in the same order as set out above.

Southern Shoreline
The function of defence along this section is principally the protection of the road and railway. There are also local properties, the sewage works and the promenade at Penmaenmawr.

Along the Garizim frontage there would be little option but to increase the robustness of defence and reduce wave overtopping. The typical approach might be to use rock. This may impinge on the SAC and SAC at the western end. However, this is an area where there is very limited foreshore width, which would, even if this were a natural shoreline, be lost with sea level rise. The approach and policy of Hold the Line is seen as being sustainable in sustaining the important transport routes.

Along the Penmaenmawr frontage, at present there are occasions when beach levels drop and the real risk in the future will be from sea level rise. Over epochs 1 and 2, it may be possible to sustain defence in much the same way as now, but with the potential need to increase the linear defence at the centre of the frontage, possibly using rock to prevent undermining. As sea level rises during epochs 2 and 3, there would be increased difficulty in maintaining the linear promenade over the full length of the area. If this were to be achieved, there would probably be the need to extend a rock revetment over the whole length and provide an improved crest wall. At the slipway, the wider section of promenade and at the sewage works would all need increased protection. In doing so, this would to some degree help to hold sediment along the rest of the frontage. The alternative would be to slightly retire the line, with the basic Hold the Line being to protect the road. There is seen to be little benefit in this as it would still result in the need for an extensive rock revetment but with the loss of infrastructure and important amenity. The difficulty is in maintaining the amenity function, however, despite the need to raise defences along the front face.


Penmaenmawr

This frontage does not provide any significant supply of sediment to the system, sediment retained at present is more typically the relic shingle and sand on the foreshore, probably recycled from the estuary system. There is a risk that if the main ebb channel flow from the estuary were able to flow more directly northward, as sea level rise reduced the influence of the harder ridge across the estuary mouth, that there could be a reduced supply of sediment from the nearshore area. This effect is very uncertain but highlights the importance of sediment sources to the area.

At Penmaen-bach, defences would be maintained. While these are essential to maintain the transport route, they are not fundamental to retaining the basic position of the point and the control it imposes on the shoreline to the north.

Morfa Conwy and the Inner Estuary.
This is discussed as one area because of the various links that are seen both in terms of the processes and the risk of flooding to the hinterland.

The defence of the road and railway would be maintained and improved to the section immediately east of Penmaen-bach. This is seen as having a beneficial impact on the dune line to the west. It is recognised that it prevents some local supply of sediment but it also holds the position of the shoreline, holding forward the general line of the dunes. The main sediment supply is seen as being that from the foreshore. The approach to future defence along Conwy Morfa is defined as selectively holding the line. This is interpreted in practice as being a responsive approach to addressing local erosion risk. The danger of this is that either harder defence would gradually be undertaken over much of the frontage or that as defences became outflanked they could result in fragmentation of the natural dune defence, exposing the area behind to increased flood risk. This uncoordinated approach is seen as being detrimental to the nature conservation of the dune and technically unsustainable much beyond epoch 1. There is also an increased risk of exposure of the landfill site in the area, with the potential for contamination of the important recreational value of the area.

The marina, the road and the industrial estate, behind Conwy Morfa, would be protected, but this development and general area would be at flood risk from the deteriorating dunes to the north. The defence of the marina may increase constraint of the estuary mouth in the future.

Impact of different Sea Level Rise Scenarios

Under the 2m sea level rise scenario, the present width of dune is unlikely to provide adequate defence to the hinterland. Under this scenario, the dune would be expected to breach and the road, marina, housing and the industrial estate would be at substantially greater flood risk. This might then mitigate against efforts to maintain defences on the eastern side of Conwy Morfa.

Conwy would continue to be defended. The quay area would be at risk from increased flooding and under this scenario there would be a need, in epoch 3, to raise the defence. This approach to defence is also taken to apply to the valley to the south of Conwy; the Gyffin, beneath the walls of the Castle. This would involve significant increase in defence levels and would increase the dependency on defence in the future. In effect, while protecting a small number of properties, there would be increased vulnerability to these properties in the event of more severe conditions

Impact of different Sea Level Rise Scenarios

There would be a need to substantially raise defences along the main quay and within the Gyffin valley under a 2m sea level rise scenario. Defences might need to be raised some 0.5m at the end of epoch 2 and a further 1.5m over epoch 3. This direct approach to managing sea level rise would have significant impact on the use of the quay and would increase the vulnerability of property within the valley.

The causeway would continue to be defended and this would maintain local access, together with the railway. Defences along the lower part of the causeway might need to be raised in the longer term to prevent deterioration of the general defence. The new defences to the A55 tunnel would also be maintained and raised. Defences all along the Deganwy frontage would be maintained and, with the intent to sustain the railway and access along the road, there would be the need to raise defence along the frontage.

With sea level rise of 1m, defence to the railway would become increasingly difficult without building forward over the estuary foreshore, in effect undertaking further reclamation linking between the tunnel entrance and Deganwy Marina and between

Deganwy Marina and Deganwy Point. There would also e issues in terms of defence to Deganwy Marina and, to hold this line, defences here would need to be raised.

Impact of different Sea Level Rise Scenarios

Under a 2m sea level rise scenario, within 75 years, significant lengths of the railway and the coastal road would be below MHWS. Under the With Present Management scenario there would need to be a substantial embankment created over the area of the foreshore. While technically feasible, this would further impact on the SSSI, the ability for the estuary to adapt to the change in conditions and would further increase the dependence on defences.

The properties at Deganwy Point would be defended under this management scenario. The crest wall would need to be raised and over the third epoch defences would have to be strengthened as erosion continues to the spit.

Overall within the inner estuary, more specifically along the eastern side, there would be significantly greater constraint of the estuary shape, loss of intertidal area (despite the potential for accretion) and far greater reliance on defence to maintain the transport corridor and to protect property. Although technically feasible, and, given the overall impact on the area, potentially justified in economic terms, the long term sustainability of the approach has to be questioned. This would need to be viewed in a broader perspective of spatial and transport planning of the whole area. Over the next 50 years the approach to defence under this scenario is considered sustainable but only in the context of developing a longer term plan for the area.

Outer Estuary - east

North of Deganwy Point, there would be, under this scenario, a need to improve the defence along the frontage to protect the railway. The present shingle beach would tend to be lost as increasing wave action works against this defence. Similarly, along the Golf Course frontage, the intent would be to Hold the Line. Despite beach management, as sea level rises there would be increasing pressure for the coast to retreat. There would be a need for increasing hard defence. The justification for defence would be in response to the flood risk to Llandudno.

There is significant economic value in maintaining and improving defence along the West Shore frontage. The draft policy for North Shore (from the adjacent SMP2) is to hold the line and this would only be sustainable if defence to West Shore was continued. The current approach is through maintenance of the breakwaters and beach management. In the future, extending this approach, there would be a need to further increase the size of the breakwaters and potentially to increase the level of defence along the old wall. Raising of defences and increasing the resilience of the defence here, either through beach recharge or through directly raising the rear defence, would be fundamental. Without such an approach the consequence, in the long term, would be regular flooding of the town, leading to the eventual abandonment of defences and the justification for managing the frontage. This approach would increasingly rely on pumped drainage of the town.

North of the West Shore frontage, the SMP1 policy is for Hold the Line. It is unlikely that this could draw funding at a national level. While it is not seen as significantly impacting on coastal processes, such works to hold the line would most probably been seen as being undertaken privately.

Upper Estuary

Under this scenario, the frontage of Llandudno Junction would continue to be defended, with the intent to investigate how defences could be improved to sustain the standard of defence. This is seen as being in line with the objectives for the area to sustain the important economic value. Under this approach it is taken that the railway line would be defended as an important part of the transport infrastructure up the valley to Llanrwst, Betws-y-Coed and the heart of Snowdonia. This has important implications in terms of management further up the valley. The implied intent would also be, therefore, to defend the Glan Conwy frontage.

While the main line of defence to Llandudno Junction is that provided by the A55, the lower front line of defence, linking through to the sluice to the Afon Ganol just north of Glan Conwy, is that provided by the defence around the Glan Conwy Nature Reserve. Under this scenario, that defence would also be maintained and improved. This would maintain the course of the Ganol to the south in front of Glan Conwy. The presence of the river in this area would appear to significantly reduce the ability of the foreshore to accrete. There are small areas of saltmarsh in front of the railway sea wall, further suggesting that in the absence of the river this area would accrete. Under present management the improving defences along the Glan Conwy frontage would require defences to be raised. With sea level rise there would be further squeeze of the mud foreshore against the defence line.

The railway and the road would need to be further defended in areas through to Tal-y-Cafn. This would not significantly constrain the natural development of this section of the estuary. Upstream of Tal-y-Cafn the intent of the CFMP is to withdraw defence to much of the valley floor. This then conflicts with the intent to maintain the route of the railway, highlighting the need for a more coordinated response. Even over the first epoch defences within the upper estuary would be at risk from failure. Recent flood events have resulted in closure of the railway line for periods of time. With sea level rise the railway would be at substantially greater risk.

It is not seen as sustainable in the long term, even maintaining defences over the next 20 years to the lower valley would be difficult. In this, the assessment would confirm the findings of the CFMP. The approach to defence at the villages is also confirmed as being sensible, in that the risk to much of the property closely associated with the villages could realistically be managed through local approaches. At Dolgarrog the risk to the aluminum works would be locally managed. However, to adopt the approach of moving away from defence in the broader area will require time for adaptation. This would be critical in considering further the approach to management of the railway as much as in allowing the agricultural industry and other interests to adapt.

The With Present Management scenario highlights important issues for future sustainability of the whole area. This is reflected in the assessment against objectives in the following tables and is discussed further in the development of policy within the next section.

4 Summary Comparison and Assessment of Baseline 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)		
No Active Intervention	**No. of properties:**		**Value x £k**	**No. of properties:**		**Value x £k**	**No. of properties:**		**Value x £k**	**No. of properties**		**PV Damages (£x1000)**
Location	*Res.*	*Com.*		*Res.*	*Com.*		*Res.*	*Com.*		*Res.*	*Com.*	
Penmaenmawr	0	0	0	0	1	6	0	0	0	3	1	3
Conwy	0	0	0	1	0	210	2	3	376	9	3	78
Deganwy	0	0	0	15	0	2,140	55	1	7,365	148	30	1,603
Llandudno WS	0	0	0	1	1	219	18	1	3,466	36	4	289
Glan Conwy	0	0	0	0	0	0	6	1	722	18	2	62
											Total for PDZ1	**2,038**
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)**
Location	*Res.*	*Com.*		*Res.*	*Com.*		*Res.*	*Com.*		*Res.*	*Com.*	
Penmaenmawr	0	0	0	0	0	0	0	0	0	0	0	0
Conwy	0	0	0	0	0	0	0	0	0	0	0	0
Deganwy	0	0	0	0	0	0	0	0	0	0	0	0
Llandudno WS	0	0	0	0	0	0	18	1	3,466	19	3	289
Glan Conwy	0	0	0	0	0	0	0	0	0	0	0	0
											Total for PDZ1	**289**

Notes: PVD determined for 1m SLR in 100 yrs.

Other information: The NAI damages do not take account of loss of the A55 or promenade at Penmaenmawr. There would be loss of services and the quay at Conwy and exposure of the landfill site at Morfa Conwy. There would be loss of the causeway, road and rail links to Llandudno and the promenade at West Shore.

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

	Flood risk tidal 2010			Flood risk tidal 2060			Flood risk tidal 2110			tidal risk 2m SLR		
No Active Intervention	**No. of properties**		**AAD**	**No. of properties**		**AAD**	**No. of properties**		**AAD**	**No. of properties**		**PVD**
Location	<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	**(£x1000)**
other	0	22	16	0	23	86	0	28	107	0	41	1387
East Penmaenmawr	0	0	0	0	0	0	0	0	0	0	0	0
Conwy	0	462	234	0	466	1235	0	487	1778	489	28	20549
Afon Conwy	0	24	7	0	29	37	0	41	118	51	35	816
Deganwy	0	320	158	0	366	198	0	484	2599	514	126	12706
Llandudno	0	4431	2253	0	4587	2543	0	4776	29941	4818	138	156571
											Total for PDZ20	192160

	Flood risk tidal 2010			Flood risk tidal 2060			Flood risk tidal 2110			tidal risk 2m SLR		
With Present Management	**No. of properties**		**AAD**	**No. of properties**		**AAD**	**No. of properties**		**AAD**	**No. of properties**		**PVD**
Location	<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	**(£x1000)**
other	0	22	8	0	23	19	0	28	107	0	41	651
East Penmaenmawr	0	0	0	0	0	0	0	0	0	0	0	0
Conwy	0	464	59	0	466	146	0	487	369	0	516	3531
Afon Conwy	0	24	4	0	29	12	0	41	118	0	86	550
Deganwy	0	320	76	0	366	96	0	484	311	0	640	3181
Llandudno	0	4431	1054	0	4587	1179	0	4776	3034	0	4956	38824
											Total for PDZ20	46794

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						
Protect properties from flood and erosion loss						
Minimise the need for increasing effort and management of coastal defences						
Avoid reliance on defence particularly where there is a risk of catastrophic failure						
Maintain access to rural communities and support their connectivity to principal support centres.						
Maintain recreational use of beaches and bays						
Maintain access to the coast including car parking and facilities						
Maintain access for boat use and associated water use activity						
Maintain existing water sport activities and facilities within the Conwy						
Maintain Llandudno as a viable commercial centre and tourist destination in a sustainable manner.						
Maintain Deganwy and Llandudno Junction as a viable commercial centre in a sustainable manner						
Maintain Conwy as an historic and vital community and tourist destination in a sustainable manner.						
Maintain character and integrity of coastal communities						
Maintain agricultural value of rural community						
Maintain agricultural industry and allow adaptation.						
Identify risk and reduce risk of loss of heritage features where possible						
Maintain historic landscape						
Prevent disturbance or deterioration to historic sites and their setting						
Maintain the value of World Heritage sites						
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.						
Maintain or enhance the condition or integrity of the national (SSSI) designated sites and interest features within the context of a dynamic coastal system						
Avoid damage to and enhance the natural landscape						

STAKEHOLDER OBJECTIVE	NAI			WPM		
	Fails	Neutral	Acceptable	Fails	Neutral	Acceptable
Maintain the human landscape and character of communities						
Maintain use of the A55 road and rail corridor.						

5 Discussion and Detailed Policy Development

The No Active Intervention scenario would fail to maintain the essential regional and national values of the area. There would be extensive loss of property, there would be risk of sudden failure of defences, with risk to life, and there would be loss of the main transport routes. Although in some areas, over the very long term, it would result in a more naturally function coast and would, therefore, be of benefit to nature conservation, over the period considered by the SMP there would be such residual impact that nature conservation may well suffer loss.

The area as a whole needs to be managed to achieve a balanced sustainability.

With Present Management in principle delivers significant benefit to the area, however, the assessment above highlights significant issues that have to be resolved. In particular, it is not so much the general principle of management under this scenario that presents the problem, as the time needed for change, to plan and adapt and, at the more detailed level, in respect of the manner in which defence may be undertaken. The discussion of this is divided in a similar manner to that taken in discussing With Present Management.

Southern Shoreline
The overall plan here has to be with the intent to Hold the Line. This is essential to maintain the main transport route. The issues really focus down to the more local management approach.

Along the Garizim frontage there is little opportunity to do other than reinforce defence and to hold the line in a linear manner.

To take a similar approach to the Penmaenmawr frontage, while still being a policy of holding the line to the main transport route, would result in loss of use of the promenade as defences have to be reinforced during epochs 2 and 3 to address sea level rise. The frontage is seen as being in quite delicate balance in terms of maintaining a beach. A significant change, such as large control structures, is likely to actually redistribute sediment in such a manner that they may result in loss of beach in some areas, increasing exposure of defences. In contrast, the existing defence, with the various man-made and natural hard points provides the opportunity to sustain a more natural frontage. Consideration could therefore be given to reinforcing this approach through local management. Maintaining the existing promontories is, therefore, seen as being an important aspect of management, with potential benefit to the long term defence of the transport route. Opportunity for local reefs and strong points could sustain amenity as well as defence of the frontage. It is unlikely that the whole of the promenade would be sustainable, but joint funding of a strategic approach to defence could be developed with greater benefit to the community. While such an approach is not seen as being necessary in the short to medium term, general agreement and investigation of a coordinated approach would be necessary in managing the shoreline even in the short term, so as to be able to respond to future need.

In considering such an approach, given that this would not necessarily maintain access along the full length of the promenade, there would be the need to also consider how better links between the promenade and the hinterland might be improved. This could help address issues raised during consultation.

Morfa Conwy and the Inner Estuary.
The problem around Morfa Conwy is of a quite a similar nature, but in relation to the soft dune frontage. At present local defence could be sustained to the dune face to prevent loss of fill from the tip. This would, however, do little to support the development of the dunes, neither as a natural resource and area for recreation, nor as a strategic flood defence in the future. Indeed, a piecemeal approach to management of this frontage would potentially weaken the ability of the dune to respond and build under future conditions.

In the short to medium term (epochs 1 and 2), it may be possible to maintain the frontage in a better condition through use of local cross-shore structures, such as rock groynes and recharge. As the coast develops; as the pressure for erosion increases and as changes within the estuary occur, there may be need for more sustained intervention to allow natural development of the dune. This may involve possible training works at the head of the dune. Such an escalation in management could start to impact on the general behaviour of both the inner and outer estuary. This would have to be planned at a broader scale, taking account of how the eastern side of the estuary mouth was being managed. The intent of the SMP would, therefore, be to manage the frontage, to sustain the dune as a semi-natural feature, in providing important defence to the area behind. This requires increasing the width of the functioning dune system in the future. This could in part be by reducing the impact of Golf Course management behind, but is as likely to require more determined management of the processes on the shoreline. The policy for the frontage, recognising the broader intent would be to Hold the Line during epochs 1 and 2, but to change to an approach of Managed Realignment in epoch 3. This is likely to involve realignment forwards, rather than retreat.

On the western inner estuary, the policy would be for Hold the Line at the marina and defences immediately to the south. This in combination with management of Conwy Morfa would provide defence to the property and industrial estate behind. The policy at Conwy would also be for Hold the Line but recognising that there would be the need to raise the quay. This also provides defence to the lower part of the town.

While it may be possible to maintain existing defences within the Gyffin Valley over epochs 1 and 2, to do so, as a policy into the long term, is not considered sustainable. There would be a need to examine further how this might impact on the school and on individual private properties.

The causeway would be held.

The main issue along the Deganwy frontage is defence to the railway and behind that the road. From a more local perspective there is also the difficulty in maintaining even the existing defence at Deganwy Point. In terms of the railway, for this is to be sustained, in the future with sea level rise, there is likely to be a need to move the defence line further over the foreshore. This may the influence the behaviour of Deganwy Point and the possibility of defence to properties in that area.

Such an approach could significantly influence the behaviour of the estuary, influencing the way in which management might be undertaken to Morfa Conwy.

If the railway were not defended, then the appropriate course of action would be to allow the shoreline to move back, creating greater width to allow build up of sediment. This would also need to take account of the estuary behaviour and this may also influence

decisions in relation to managing Deganwy Point. In the short term and potentially during epoch 2 the policy for the whole eastern length of the inner estuary would be to Hold the Line. It is very unlikely, however, to be sustainable in the long term. It also seems unlikely that the present defence at Deganwy Point could necessarily be held. The defence might fail during epoch 2 but certainly during epoch 3. The policy for the whole frontage would be Managed Realignment in epoch 3. This could be forward or backwards and these decisions need to be considered in terms of integrated spatial and transport planning for the area. This would need to take account of management across the estuary at Morfa Conwy. As such, even though defined as separate policy units, a strategy for management (both spatial and coastal) would need to be developed for the whole area.

The bay to the north of Deganwy Point, Traeth Melyn, would be influenced by any realignment at Deganwy Point. Furthermore, given that defence is primarily to the railway line, the management is dependent on decisions as to the future of the line to the south. As such this frontage should be considered as part of a management unit with the coast to the south, despite its more open coastal behaviour. At present, however, based on the intent to sustain the transport route through to Llandudno, the policy would be for Hold the Line over all epochs.

Outer Estuary - east

The main approach to defence over the entire West Shore frontage, including defence of the valley through the southern section of the Golf Course, has changed over the last 30 years, from maintenance of a linear defence to one of controlling and managing sediment along the shoreline in support of that linear defence. This is seen as being sustainable over the short to medium term (epochs 1 and 2). The driver for this defence is primarily the flood risk to Llandudno but also to provide an important amenity resource for the region. Over epochs 1 and 2 the policy would be Hold the Line to deliver this intent.

In the future, with sea level rise, the present system will be harder to maintain purely through beach management and maintenance of the breakwaters. There will be a need to improve the standard of defence and, to either, raise defences to the old defence line or increase defence width; with then the intent to raise defences within a broader width of land. The latter is considered to offer significantly greater flexibility and longer term sustainability. This may be achieved in part by increasing the size and height of the breakwaters but may also require greater use of the open areas behind the old line of defence.

In particular, south of the southern breakwater, the beach width will become harder to maintain. It would be sensible to plan setting back behind the old defence line to create the opportunity for a more sustainable beach. The same approach may be necessary along the main section of West Shore. Here, use would be made of the open green area to allow development of a more natural beach crest and higher defence level. Either approach to raising the defence will result in significant impact on the landscape of the area. It is, however, only potentially by taking advantage of any additional width that this impact could be mitigated to some degree through landscaping.

The section of shoreline immediately to the north of the northern breakwater provides protection to the road running around the Great Orme and provides access to the properties in the Gogarth area. In defining a policy unit boundary between the area of West Shore and Gogarth, it has been recognised that it is sensible to extend this to include the length of road providing common access to properties. The intent within this

section is to continue to manage the defences as discussed more generally for the West Shore section, discussed above. However, consideration should be given to establishing a framework of joint funding for such work, recognising private benefit derived from such defence.

North of this section, the policy would be for No Active Intervention. This would not preclude the possibility of local private management subject to normal approvals.

Upper Estuary

The SMP would confirm the intent described in the CFMP, to maintain and improve defence in line with sea level rise to the area of Llandudno Junction. As identified in the CFMP there is the need to consider how this could be achieved. To raise defence along the full length of the Nature Reserve, in line with sea level rise, is not considered appropriate in delivering this objective. In fact, such an approach could unnecessarily constrain opportunities for more sustainable defence of the town and the valley. Without this constraint, this would provide the opportunity for a more natural saltmarsh to develop, offering important protection to defences behind. In addition, by being able to consider management across the whole mouth of the Afon Ganol, there is the opportunity for the river channel to be moved away from the Glan Conwy frontage. This has the potential to provide greater protection to this frontage as saltmarsh develops. Under such an approach, the policy for the area, as a whole, is to Hold the Line during epochs 1 and 2, with a policy of managed realignment in epoch 3. The specific intent would be to maintain and improve defence to Llandudno Junction and the Afon Ganol Valley, to maintain defence to Glan Conwy with the future intent to examine how defence to the railway line and the low lying land in the village could be improved in the future.

This plan intent, with respect to the railway would, however, depend on decisions to maintain the railway through the Conwy Valley.

Between Glan Conwy and Tal-y- Cafn, there would be an intent to maintain defence of the railway across the flood plain on the eastern side of the estuary. The policy would, therefore, be to Hold the Line. There would be no intent to defend land on the western bank.

At Tal-y-Cafn, the policy would be to maintain existing defence to low lying land initially over epoch 1. From epoch 2 onwards the policy would be for managed realignment. This would need to be considered in detail, to establish road levels. The realignment would take the railway line as the limit of defence.

Further up the valley, the intent is to restore the natural flood plain of the valley. Long term defence of this area is not seen as being sustainable. In the short term, the policy would be to maintain defences, allowing an initial period of adaptation. This aim would need to be discussed further with landowners to consider how adaptation could be facilitated further. The key constraint would be the railway embankment. The intent for flood management would be to relocate the railway, rather than the significant investment being used to raise the railway and its embankment in the future. This approach would obviously need to be developed further and in relation to the national transport policy for Wales.

As sea level continues to rise over epoch 2 and 3, consideration would be given to local defence measures being undertaken to the villages within the valley.

6 Management Summary.

The following tables summarise policy developed above. The shoreline has been divided into management units, reflecting the interaction between policy units both in terms of coastal processes and essential issue.

MA59 SOUTHERN SHORELINE: From Llanfairfechan To Penmaen- Bach

Policy Unit		**Policy Plan**			
		2025	**2055**	**2105**	**Comment**
20.1	Garizim	HTL	HTL	HTL	
20.2	Penmaenmawr	HTL	HTL	HTL	Joint funding approach to sustain use of the promenade, road and railway.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

MA60 INNER ESTUARY AND ASSOCIATED SHORELINE: Conwy Morfa through to the bridges and from the bridges north to Traeth Melyn

Policy Unit		**Policy Plan**			
		2025	**2055**	**2105**	**Comment**
20.3	Conwy Morfa	HTL	HTL	MR	Possible realignment forward, to be considered in conjunction with management at Deganwy.
20.4	Conwy Marina	HTL	HTL	HTL	
20.5	Conwy	HTL	HTL	HTL	
20.6	Gyffin Valley	HTL	HTL	MR	
20.7	Causeway	HTL	HTL	HTL	
20.8	Deganwy	HTL	HTL	MR	Decisions in relation to the railway line and Marina and from a spatial planning perspective. MR to be considered in conjunction with management at Conwy Morfa
20.9	Deganwy Point	HTL	HTL/ MR	MR	MR to be considered in conjunction with management at Conwy Morfa and the unit above.
20.10	Traeth Melyn	HTL	HTL	HTL	Subject to maintaining the railway line. The default policy would MR.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

MA61 OUTER ESTUARY EAST: Traeth Melyn to Great Orme Head

Policy Unit		**Policy Plan**			
		2025	**2055**	**2105**	**Comment**
20.11	West Shore and Golf Course	HTL	HTL	MR	With the intent to sustain and improve flood defence in line with sea level rise to Llandudno
20.12	Gogarth	NAI	NAI	NAI	This would not preclude private defence subject to normal approvals
20.13	Great Orme Head	NAI	NAI	NAI	
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

MA62 UPPER ESTUARY: The Causeway through to Llanrwst

Policy Unit		Policy Plan			
		2025	**2055**	**2105**	**Comment**
20.14	West to Tal-y-Cafn	NAI	NAI	NAI	This would not preclude private defence investment subject to normal approvals
20.15	Llandudno Junction and Ganol Estuary	HTL	HTL	MR	With the intent to sustain defence in line with sea level rise. Realignment would be through the Nature Reserve
20.16	Glan Conwy	HTL	HTL	HTL	Subject to maintaining the railway line
20.17	Glan Conwy to Tal-y-Cafn	HTL	HTL	HTL	This would be driven by the need to protect the railway.
20.18	Tal-y-Cafn	HTL	MR	MR	Retire defence to the railway line
20.19	Tal-y-Cafn to Llanrwst	HTL	MR	NAI	The intent would be to relocate the railway line to the edge of the tidal flood plain. Under the long term policy local defence to villages would be considered further.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PDZ 20
Management Area Statements

MA 59 Southern Shoreline
Llanfairfechan to Penmaen Bach

MA 60 Inner Estuary and Associated Shoreline
Conwy Morfa through to the bridges and from the bridges north to Traeth Melyn

MA 61 Outer Estuary East
Traeth Melyn to Great Orme Head

MA 62 Upper Estuary
The Causeway to Llanrwst

Location reference:	**Southern Shoreline**
Management Area reference:	**M.A. 59**
Policy Development Zone:	PDZ20

* 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. 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 59, 60 & 61
Management Area
Policy Unit
Policy Development Zone
Scheduled Monument
N
Holyhead
Bangor
Caernarfon
Dolgellau
Aberystwyth
Ianguric
Fishguard
Carmarthen
Swansea
GREAT ORME'S HEAD
Great Orme
PU20.13
PU20.12
MA61
PU20.11
MA60
PU20.10
PU20.9
PU20.3
PU20.4
PU20.8
PU20.5
MA59
PU20.2
CONWY
PU20.7
PU20.6
PU20.15
PU20.1
PU20.14
PU20.17
MA62
0
1
2 Kilometres
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2010. All rights reserved. Ordnance Survey licence number 100026380
Key
100 Year Shoreline Position:
Preferred Policy would be the same as With Present Management
With Present Management where this differs from the Preferred Policy
Preferred Policy where this differs from the With Present Management
Ramsar
SAC
SPA
SSSI
NNR
Exisitng Indicative EA Flood Zone 3
EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding
ROYAL HASKONING

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

INTENT OF THE PLAN:

The aim of the plan is to continue to provide defence to the main transport routes and in delivering this there would also be good justification for sustaining the use of the shoreline immediately in front of the railway.

In the longer term there may a need to for some readjustment of the defence line and the approach to defence so as to retain use of the frontage while still supporting the promenade and the foreshore. This approach could include consideration of foreshore habitat gain.

KEY ISSUES/RISK AND UNCERTAINTY:

There are uncertainties in terms of timing of the potential impacts and response of the coast. There would be a need to develop a plan for such response so that works to defend the frontage are undertaken with a view to the future.. It will be important to relate this to national monitoring of sea level rise and more general climate change and to continued monitoring of coastal change.

To maintain use of the promenade there will be a need to establish collaborative funding approach with highways and Network Rail.

ACTIONS:

ACTION	PARTNERS	
Shoreline monitoring	**CC**	**Network Rail**
Examine joint funding arrangements	**CC**	**Highways**
	Network Rail	**EA**
Potential for habitat creation	**EA**	**CCW**

DELIVERY OF THE PLAN

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
20.1	Garizim	HTL	HTL	HTL	
20.2	Penmaenmawr	HTL	HTL	HTL	Joint funding approach to sustain use of the promenade, road and railway.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
From present day	Maintain existing defences. Address safety issues at Garizim. While the policy is to Hold the Line, the SMP highlights the need to consider how this could be achieved through local realignment of defences. This would need to be developed. Develop adaptation planning. Develop funding plan.
Medium term	Maintain defences while moving towards adaptive management.
Long term	Implement community based adaptation.

IMPLICATIONS OF THE PLAN

CHANGES FROM PRESENT MANAGEMENT

No substantial change.

ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	211.3	590.6	717.5	1,519.5
Preferred Plan Damages	110.8	164.0	432.8	707.6
Benefits	100.5	426.6	284.8	811.9
Costs	0.0	2,255.4	1,108.5	3,363.9

Note: the above table does not include the potential damages resulting from the loss of the transport routes. A joint funding approach is important to management of defences in this area.

FLOOD AND EROSION RISK MANAGMENT

POTENTIAL LOSS

There would still be flood risk to the use of the area.

BENEFITS OF THE PLAN

The plan provides a longer term sustainable approach to defence of the main transport routes, with the intent to sustain amenity use of the area. The plan would reduce flood risk to some 26 properties.

SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)

PDZ 20				
SEA Objective	**Impact of Preferred Policy for each Epoch**			
	1	**2**	**3**	**Mitigation**
Policy Units 20.1 to 20.19				
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).				Habitat creation
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				Habitat creation
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.				Sensitive design of HTL and MR actions
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.				
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.				

Mitigation associated with the impacted features of the historic environment may include excavation and recording and monitoring of erosion rates.

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

Anticipated Habitat Loss in PDZ 20 as a result of SMP Policy

Designated Site	PU	Habitat Type	Extent of Loss of Habitat (ha)			
			Epoch 1	Epoch 2	Epoch 3	Total
Menai Strait and Conwy Bay SAC	20.1	Intertidal sandflat	0.00	0.03	0.01	0.04

Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC: It is concluded that there would be an **adverse effect on the integrity** of the intertidal habitat (sandflat) within the boundary of the SAC as a result of the SMP2 policies. There will however, be **no adverse effect on the integrity** of the other SAC features.

6.1 *Great Orme`s Head/ Pen y Gogarth SAC:* **no adverse effect on the integrity**.

Traeth Lafan / Lavan Sands, Conwy Bay SPA: It is concluded that there would be an **adverse effect on the integrity** of the populations of the qualifying interests (due to the reduction in the extent of supporting habitat that is predicted) within the boundary of the SPA as a result of the SMP2 policies.

Preventative/mitigation measures: None identified.

Risks/Assumptions: The habitat loss is considered precautionary, and where any works are to be undertaken detailed study would provide an accurate identification of whether habitat would be lost and the extent. The areas of potential habitat loss are small, but do not take into account accretion of sediments within the area and how this would influence the development of intertidal sandflat.

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**			
Menai Strait (Coastal – C8) (PDZ part 16, part 17and part 20) (MAN part 41, 42, 43, 44, 45, 46, 47 and 59)	N/A	✓	✓	✓	**No** - not necessary as delivery of the WFD Environmental Objectives will not be prevented by the SMP policies and in some cases will ensure they are of benefit.	**Yes (partly)** – One of the three relevant mitigation measures for this water body has been implemented, which then provides potential for one of the other measures to be put in place.	• **Managed realignment of flood defence -** MR within the following policies: **PU 16.4, 16.5, 16.11, 16.17** will allow the coastline to be more sustainable and adaptive to sea level rise. • **Removal of hard bank reinforcement -** could be implemented as part of the MR. • **Modify structure or reclamation.**
Conwy Bay (Coastal) (PDZ part 20) (MAN 59)	N/A	✓	✓	✓	**No** - not necessary as delivery of the WFD Environmental Objectives will not be prevented by the SMP policies and in some cases will ensure they are of benefit.	There were no relevant measures to the SMP2 for this water body.	N/A

Location reference:	**Inner Estuary and Associated Shoreline**
Management Area reference:	**M.A. 60**
Policy Development Zone:	PDZ20

* 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. 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.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Management Area 59, 60 & 61
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Policy Development Zone
Scheduled Monument
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Holyhead
Bangor
Caernarfon
Dolgellau
Aberystwyth
Ianguric
Fishguard
Carmarthen
Swansea
GREAT ORME'S HEAD
Great Orme
PU20.13
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PU20.7
PU20.6
PU20.15
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Key
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With Present Management where this differs from the Preferred Policy
Preferred Policy where this differs from the With Present Management
Ramsar
SAC
SPA
SSSI
NNR
Exisitng Indicative EA Flood Zone 3
EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding
ROYAL HASKONING

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

INTENT OF THE PLAN:

The overall intent of the Plan within this area is to sustain the vital economic, commercial and historic areas around the entrance of the Conwy Estuary. There are significant risks both from erosion and in particular flooding with sea level rise. The plan highlights the need for adaption both in the way in which defences might need to be managed and potentially in terms of land use and the need for greater reliance in terms of addressing flood risk.

The whole area would be sensitive to the way in which defences were managed, in that defence at Morfa Conwy, Deganwy Point and along the Deganwy shoreline could impact on the flow regime, the movement of sediment and the behaviour of the shoreline. At present the approach to defence of Morfa Conwy might consider moving from a strictly linear approach to considering more local cross shore controls. If this were then developed this could have implications for management at Deganwy Point. There would therefore be need in the medium term to develop a consistent approach to management of both frontages. The current approach to defence at Deganwy Point is not viewed as being sustainable much beyond epoch 1. However, local realignment might provide the width to continue to provide sustainable management of the risk.

The issues along the Deganwy frontage are principally associated with maintaining a sustainable defence to the railway in the future. There may be the need to consider forward realignment to create the necessary width in defence. This needs to take account of the existing risk to the Marina and this all needs to be considered as a whole strategy rather than as a piecemeal response. Within this there is the need to consider potential for habitat creation and enhancement.

The main water front of Conwy would be sustained but there would need to be consideration of how use could be adapted with sea level rise. Within the Gyffin valley, the intent of the plan would be to look for managed realignment to provide a more sustainable approach. This could impact on the school, car parks and properties.

KEY ISSUES/RISK AND UNCERTAINTY:

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

There is generally strong economic justification for continued defence but to achieve a sustainable approach sympathetic to the use and landscape of the area there would need to be collaborative funding.

ACTIONS:

ACTION	PARTNERS	
Shoreline monitoring	**CC**	**Network Rail**
Adaption planning and strategic planning of defence over the whole area.	**CC** **Communities** **EA** **CCW**	 **Highways** **Network Rail**
Adaption planning within the Gyffin Valley	**EA** **CC**	 **Property owners**

DELIVERY OF THE PLAN

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
20.3	Conwy Morfa	HTL	HTL	MR	Possible realignment forward, to be considered in conjunction with management at Deganwy.
20.4	Conwy Marina	HTL	HTL	HTL	
20.5	Conwy	HTL	HTL	HTL	
20.6	Gyffin Valley	HTL	HTL	MR	
20.7	Causeway	HTL	HTL	HTL	
20.8	Deganwy	HTL	HTL	MR	Decisions in relation to the railway line and Marina and from a spatial planning perspective. MR to be considered in conjunction with management at Conwy Morfa.
20.9	Deganwy Point	HTL	HTL/ MR	MR	MR to be considered in conjunction with management at Conwy Morfa and the unit above.
20.10	Traeth Melyn	HTL	HTL	HTL	Subject to maintaining the railway line. The default policy would MR.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
From present day	Maintain existing defences and improve defence along Conwy Morfa. Develop adaptation and strategic planning. Develop funding plan.
Medium term	Maintain defences while moving towards adaptive management.
Long term	Implement strategic plan for defence.

IMPLICATIONS OF THE PLAN

CHANGES FROM PRESENT MANAGEMENT

There will be the need for change throughout the area to develop a strategic approach to defence to still sustain risk management.

ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	4,907.1	10,854.0	19,189.6	34,950.7
Preferred Plan Damages	1,705.9	2,118.1	10,142.1	13,966.0
Benefits	3,201.2	8,735.9	9,047.6	20,984.7
Costs	158.9	1,357.8	1,591.4	3,108.0

FLOOD AND EROSION RISK MANAGMENT

POTENTIAL LOSS

It is not possible at this stage to fully define specific loss or increased flood risk. This would be subject to the strategic plan for risk management. There are likely to be properties within the Gyffin valley that may be subject to increased risk in epoch 3.

BENEFITS OF THE PLAN

The plan provides a framework for examining strategic management throughout the area. The aim of the plan would be to continue to manage flood and erosion risk, with the potential to reduce flood risk to over 1000 properties.

SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)

PDZ 20				
SEA Objective	**Impact of Preferred Policy for each Epoch**			
	1	**2**	**3**	**Mitigation**
Policy Units 20.1 to 20.19				
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).				Habitat creation
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				Habitat creation
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.				Sensitive design of HTL and MR actions
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.				
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.				

Mitigation associated with the impacted features of the historic environment may include excavation and recording and monitoring of erosion rates.

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

Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC: It is concluded that there would be an **adverse effect on the integrity** of the intertidal habitat (sandflat) within the boundary of the SAC as a result of the SMP2 policies. There will however, be **no adverse effect on the integrity** of the other SAC features.

6.2 *Great Orme`s Head/ Pen y Gogarth SAC:* **no adverse effect on the integrity**.

Preventative/mitigation measures: None identified.

Risks/Assumptions: The habitat loss is considered precautionary, and where any works are to be undertaken detailed study would provide an accurate identification of whether habitat would be lost and the extent. The areas of potential habitat loss are small, but do not take into account accretion of sediments within the area and how this would influence the development of intertidal sandflat.

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**			
Conwy (Transitional) (PDZ 20) (MAN 60, 61 and 62)	N/A	**x** **(PDZ 20)**	**x** **(PDZ 20)**	✓	**Yes** – Environmental Objectives WFD2 and 3 may not be met because of the SMP policy in PDZ20 (MANs 60 & 62).	**Yes (partly)** – 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.	• **Managed realignment of flood defence** - MR within the following: **PU 20.9, 20.18, 20.19** will allow the coastline to be more sustainable and adaptive to sea level rise. • **Removal of hard bank reinforcement -** could be implemented as part of the MR; **or replacement with soft engineering solution.** • **Preserve ecological value of marginal habitat, banks and riparian;**

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**
Conwy (Transitional – T19) **PUs 20.3 – 20.10** (WFD 2) **PU 20.5** (WFD 3) **PUs 20.16 – 20.17** (WFD 2)	**Mitigation measures:** 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 required.	**RBMP mitigation measures incorporated into SMP policies:** • One of the mitigation measures in the Western Wales RBMP for this transitional water body is to be implemented through the SMP2 policies within PUs 20.9, 20.18 and 20.19, which will allow the coastline to be more sustainable and adaptive to sea level rise. The rivers banks will be able to accrete sediments along the foreshore, and thus improve the benthic invertebrate communities. This policy also has the potential to achieve one other mitigation measure, though this will depend on how the MR is determined, for example, removal of hard bank reinforcement for any obsolete structures. **Other potential mitigation measures that could be required:** • Develop a more sustainable coastal management plan/strategy for the estuary to take account the coastal processes and flood risk linkages between the open coast and the Conwy Estuary. • Undertake environmental monitoring of the designated sites. • Ensure the SMP2 policies and flood and erosion risks are accounted for in the next revisions of

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
		land use plans.
	Affect on other Water Bodies: can it be demonstrated that the preferred SMP policies do not permanently exclude or compromise the achievement of the objectives of the Directive in Water Bodies within the same River Basin District that are outside of the SMP2 area?	The Environment Agency Flood Map application, Groundwater maps and the Western Wales RBMP have been consulted to check for landward freshwater and groundwater bodies that potentially could be impacted by SMP2 policies. There are two FWBs that discharge into this TraC Water Body. It was considered that the mouth of the 'unnamed Conwy Estuary west (PU20.5)' river is constrained because of the SMP2 policy and has the potential to compromise the Environmental Objectives of the WFD for this river water body, by preventing GES being achieved. It is unlikely that the integrity or Ecological Status of the Gyffin River (PU20.6) will be compromised. The assessment also concluded that the Conwy GWB will be not be impacted as a result of the SMP2 policies as there is no current evidence of saline intrusion (see **Assessment Table 3** and **Section K3.3**).
	Other issues: 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)?	The outer and part of the middle section of the estuary is designated as part of the Menai Strait and Conwy Bay SAC, with much of the estuary also being designated as the Aber Afon Conwy SSSI, which is of special interest for its marine and terrestrial invertebrate biology. The Habitats Regulations Assessment concluded that the HTL policies for PUs 20.3 to 20.10, and 20.16 and 20.17 would not result in causing an adverse impact on the integrity of the SAC.

Location reference:	**Outer Estuary East**
Management Area reference:	**M.A. 61**
Policy Development Zone:	PDZ20

* 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. 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.


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Baseline Location Map
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Policy Development Zone
Scheduled Monument
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Ianguric
Fishguard
Carmarthen
Swansea
GREAT ORME'S HEAD
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Preferred Policy where this differs from the With Present Management
Ramsar
SAC
SPA
SSSI
NNR
Exisitng Indicative EA Flood Zone 3
EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding
ROYAL HASKONING

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

INTENT OF THE PLAN:

The main focus of management is in addressing the long term risk to Llandudno from flooding and erosion along West Shore.

Key areas for management would be along the golf course frontage and at West Shore itself. Current management is through control structures and beach management. This is viewed as being a sustainable approach. However, with sea level rise, there would be an increased risk of wave overtopping at West Shore and increased pressure for erosion along the golf course. Consideration will need to be given to adapting the defence in the longer term such that there is opportunity to provide more width for sustainable management of the present defence system. This may mean setting back the formal defence along West Shore, with the potential to encourage beach or dune growth.

At present there are concerns over wind blown sand over the promenade and affecting properties. It is difficult to exclude this problem while still maintaining the present approach to defence. Clearance of sand and replacing it on the foreshore offers temporary relief but is primarily a recycling process. Sand fencing along the promenade may offer some further relief but, while moving towards the change in character of the frontage that may be necessary in the medium to long term would impact on the current character of the frontage. This approach, however, could be discussed through consultation with a view to starting consultation about the need for longer term change.

The intent of the plan would be to support defence along the road around the Great Orme and continue to maintain access to properties at Gogarth. However, the plan would not extend to formal defence along the frontage of the properties. The plan would not exclude private defence, subject to normal approvals.

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, this process and discussion could be started in discussion of the current wind blown sand issues. The development of the future plan will need to be related to national monitoring of sea level rise and more general climate change, as well as to continued monitoring of beach behaviour.

There is strong economic justification for continued management. However, to undertake this in a manner sympathetic to the landscape, nature conservation value and use of the area, there is likely to be a need for collaborative funding.

ACTIONS:

ACTION	PARTNERS	
Shoreline monitoring	**CC**	
Adaption planning at West Shore	**CC** **Community** **EA**	 **Highways** **CCW**
Assess in detail potential impact on historic environment	**CADW**	

DELIVERY OF THE PLAN

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
20.11	West Shore and Golf Course	HTL	HTL	MR	With the intent to sustain and improve flood defence in line with sea level rise to Llandudno.
20.12	Gogarth	NAI	NAI	NAI	This would not preclude private defence subject to normal approvals.
20.13	Great Orme Head	NAI	NAI	NAI	
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
From present day	Maintain existing defences and developing funding framework for management of northern section of the frontage. Start discussion for longer term adaptation planning.
Medium term	Maintain defences while moving towards adaptive management
Long term	Implement community based adaptation.

IMPLICATIONS OF THE PLAN

CHANGES FROM PRESENT MANAGEMENT

The approach to defence remains substantially the same but there needs to be planning of how this would be taken forward in the medium to long term.

ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	28,208.6	26,737.9	101,963.7	156,910.2
Preferred Plan Damages	13,195.0	12,450.3	13,476.2	39,121.5
Benefits	15,013.6	14,287.6	88,487.5	117,788.7
Costs	34.2	1,726.3	1,080.4	2,840.9

FLOOD AND EROSION RISK MANAGMENT

POTENTIAL LOSS

There would be potential long term erosion and cliff stability issues with respect to property at Gogarth. This would need to be considered by individuals.

BENEFITS OF THE PLAN

The plan provides a longer term sustainable approach to defence to Llandudno. There would still be a high residual risk to the town. The plan aims to reduce flood risk to over 4000 properties.

SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)

PDZ 20				
SEA Objective	**Impact of Preferred Policy for each Epoch**			
	1	**2**	**3**	**Mitigation**
Policy Units 20.1 to 20.19				
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).				Habitat creation
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				Habitat creation
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.				Sensitive design of HTL and MR actions
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.				
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.				

Mitigation associated with the impacted features of the historic environment may include excavation and recording and monitoring of erosion rates.

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

Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC: It is concluded that there would be an **adverse effect on the integrity** of the intertidal habitat (sandflat) within the boundary of the SAC as a result of the SMP2 policies. There will however, be **no adverse effect on the integrity** of the other SAC features.

6.3 *Great Orme`s Head/ Pen y Gogarth SAC:* **no adverse effect on the integrity**.

Preventative/mitigation measures: None identified.

Risks/Assumptions: The habitat loss is considered precautionary, and where any works are to be undertaken detailed study would provide an accurate identification of whether habitat would be lost and the extent. The areas of potential habitat loss are small, but do not take into account accretion of sediments within the area and how this would influence the development of intertidal sandflat.

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**			
Conwy (Transitional) (PDZ 20) (MAN 60, 61 and 62)	N/A	**x** **(PDZ 20)**	**x** **(PDZ 20)**	✓	**Yes** – Environmental Objectives WFD2 and 3 may not be met because of the SMP policy in PDZ20 (MANs 60 & 62).	**Yes (partly)** – 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.	• **Managed realignment of flood defence** - MR within the following: **PU 20.9, 20.18, 20.19** will allow the coastline to be more sustainable and adaptive to sea level rise. • **Removal of hard bank reinforcement -** could be implemented as part of the MR; **or replacement with soft engineering solution.** • **Preserve ecological value of marginal habitat, banks and riparian;**

Location reference:	**Upper Estuary**
Management Area reference:	**M.A. 62**
Policy Development Zone:	PDZ20

* 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.

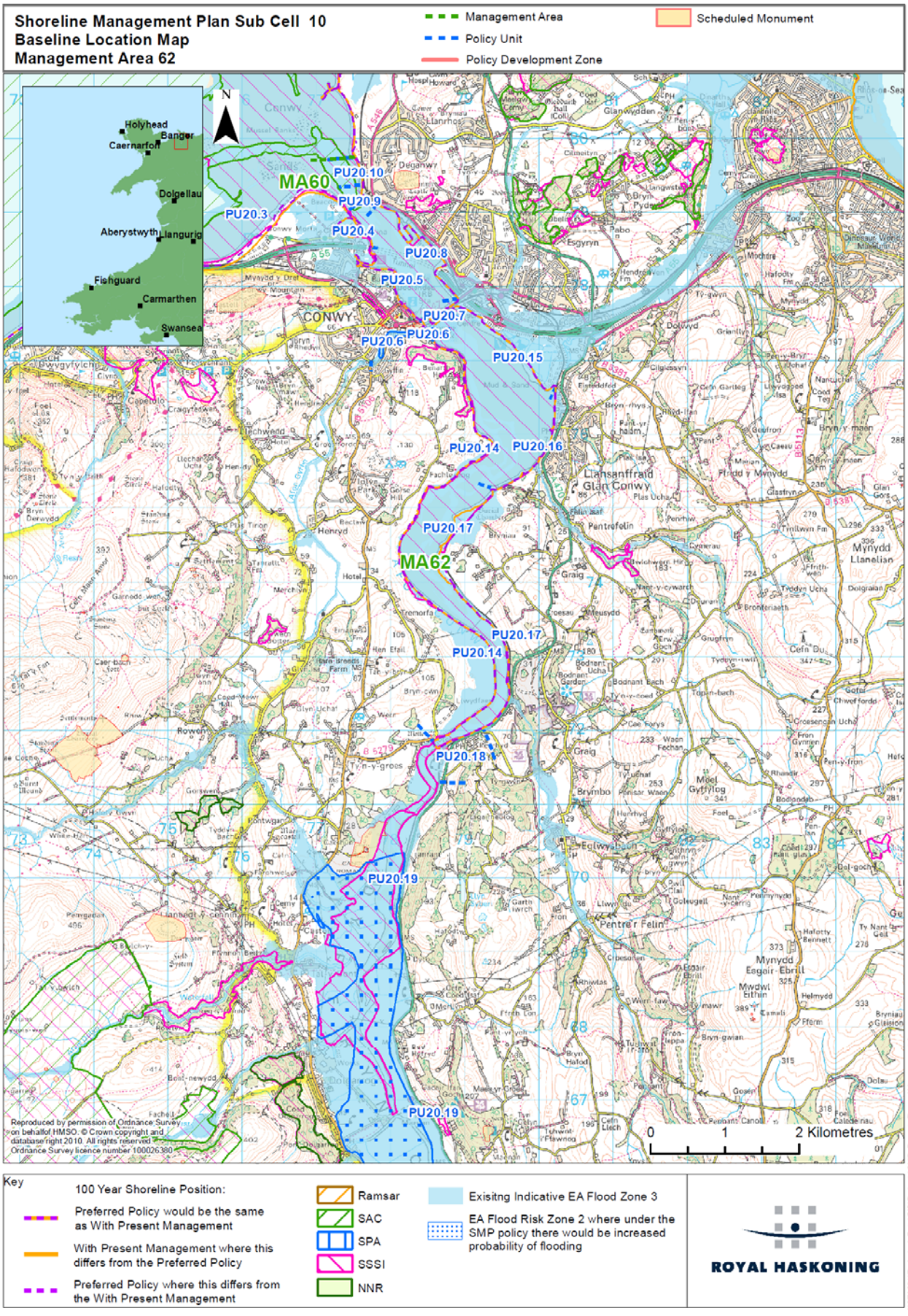
Flood Risk Zones

General Flood Risk Zones. The explanation of these zones is provided on the Environment Agency's web site www.environment-agency.gov.uk. 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 62
Management Area
Policy Unit
Policy Development Zone
Scheduled Monument
Holyhead
Bangor
Caernarfon
Dolgellau
Aberystwyth
Aberystwyth
Fishguard
Carmarthen
Swansea
N
MA60
MA62
PU20.10
PU20.9
PU20.3
PU20.4
PU20.8
PU20.5
PU20.7
PU20.6
PU20.6
PU20.15
PU20.14
PU20.16
PU20.17
PU20.17
PU20.14
PU20.18
PU20.19
PU20.19
CONWY
Llansanffraid Glan Conwy
Pentrefelin
Pentre'r Felin
Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2010. All rights reserved. Ordnance Survey licence number 100026380
0
1
2 Kilometres
Key
100 Year Shoreline Position:
Preferred Policy would be the same as With Present Management
With Present Management where this differs from the Preferred Policy
Preferred Policy where this differs from the With Present Management
Ramsar
SAC
SPA
SSSI
NNR
Exisitng Indicative EA Flood Zone 3
EA Flood Risk Zone 2 where under the SMP policy there would be increased probability of flooding
ROYAL HASKONING
I:\9T9001\Technical_Data\GIS\Projects\SMP_Report_Figures\Management Areas

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

INTENT OF THE PLAN:

Management of flood risk in this area will be under significant pressure as a result of climate change and sea level rise.

The intent of the plan is to continue to provide flood defence to core areas of Llandudno Junction and Glan Conwy. The present defences rely heavily on the embankment to the A55. The intent would be to maintain this defence. The defence then relies on management of flood risk via the Afon Ganol. This watercourse is artificially held on its current course by historic defence to the Glan Conwy nature reserve. This results in low foreshore levels in front of Glan Conwy. With the intent to continue to defend this whole area, together with the railway line, the SMP recommends looking at implementing change to the course of the river, allowing and encouraging it to take a more natural route and allowing development of saltmarsh at Glan Conwy.

Between Glan Conwy and Tal-y-Cafn, the main defence relies on and is justified by the defence to the railway line. Subject to the need to sustain the railway the intent of the plan would be for continued defence.

Upstream of Tal-y-Cafn the CFMP has identified that continued defence of agricultural land along the floor of the Conwy Valley would not be considered sustainable. This is confirmed by the SMP. The intent within the plan would be to support management of defences in the short term but with the further intent to abandon defence within epoch 2. There would need to be a separate decision as to defence of the railway, but given the constraint the line imposes on the natural development of the river valley, along side the significant investment that would be needed to raise the railway to an appropriate level to take account of sea level rise, consideration should be given to realignment. Local defence measures would be considered under the plan with the intent to reduce flood risk to villages to the side of the estuary. This would need to consider also the risk of tidal locking of water courses.

KEY ISSUES/RISK AND UNCERTAINTY:

There are uncertainties in terms of timing of the proposed changes, although the defences within the upper valley are already considered to be unsustainable. There is 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.

There are potential funding issues with respect to defence at Glan Conwy and this would need to be resolved through potential collaborative funding in relation to the railway. This however, needs to be viewed in terms of an overall strategic approach to the broader flood risk to the whole area.

Adaption to increased flood risk needs to be discussed with landowners and funding may be required to facilitate the change in approach. Without this there could be a piecemeal approach to private defence funding and the potential benefits for sustainable management of the area would be lost.

ACTIONS:

ACTION	PARTNERS	
Determine strategic approach to flood defence of Llandudno Junction and Glan Conwy	**CC** **EA** **CCW**	**Network Rail**
Adaption planning within the Conwy valley	**EA** **Landowners** **Network Rail**	**Highways** **CC**
Assess in detail potential impact on historic environment	**CADW**	
Examine opportunities for habitat creation	**EA**	**CCW**

DELIVERY OF THE PLAN

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025	**2055**	**2105**	**Comment**
20.14	West to Tal-y-Cafn	NAI	NAI	NAI	This would not preclude private defence investment subject to normal approvals
20.15	Llandudno Junction and Ganol Estuary	HTL	HTL	MR	With the intent to sustain defence in line with sea level rise. Realignment would be through the Nature Reserve
20.16	Glan Conwy	HTL	HTL	HTL	Subject to maintaining the railway line.
20.17	Glan Conwy to Tal-y-Cafn	HTL	HTL	HTL	This would be driven by the need to protect the railway
20.18	Tal-y-Cafn	HTL	MR	MR	Retire defence to the railway line.
20.19	Tal-y-Cafn to Llanrwst	HTL	MR	NAI	The intent would be to relocate the railway line to the edge of the tidal flood plain. Under the long term policy local defence to villages would be considered further.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

PREFERRED POLICY TO IMPLEMENT PLAN:	
From present day	Maintain existing defences. Develop strategic and adaptation planning. Develop funding plan.
Medium term	Maintain defences at Glan Conwy while moving towards adaptive management within the upper estuary.
Long term	Implement strategic defence plan.

IMPLICATIONS OF THE PLAN

CHANGES FROM PRESENT MANAGEMENT

No substantial change in management.

ECONOMIC SUMMARY

Economics (£k PV)	by 2025	by 2055	by 2105	Total £k PV
NAI Damages	2,057.3	2,227.7	9,303.5	13,588.4
Preferred Plan Damages	1,005.1	1,048.4	1,678.5	3,732.1
Benefits	1,052.2	1,179.2	7,624.9	9,856.3
Costs	3,760.4	3,217.0	889.1	7,866.5

FLOOD AND EROSION RISK MANAGMENT

POTENTIAL LOSS

There would be increased flooding within the Conwy Valley.

BENEFITS OF THE PLAN

The plan provides a longer term sustainable approach to risk management with the intent to reduce flood risk to over 200 properties.

SUMMARY OF STRATEGIC ENVIRONMENTAL ASSESSMENT (INCLUDING HRA)

PDZ 20				
SEA Objective	**Impact of Preferred Policy for each Epoch**			
	1	**2**	**3**	**Mitigation**
Policy Units 20.1 to 20.19				
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).				Habitat creation
To avoid adverse impacts on, conserve and where practical enhance the designated interest of nationally designated nature conservation sites. Maintain/achieve favourable condition.				Habitat creation
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.				Sensitive design of HTL and MR actions
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.				
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.				

Mitigation associated with the impacted features of the historic environment may include excavation and recording and monitoring of erosion rates.

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

Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC: It is concluded that there would be an **adverse effect on the integrity** of the intertidal habitat (sandflat) within the boundary of the SAC as a result of the SMP2 policies. There will however, be **no adverse effect on the integrity** of the other SAC features.

Preventative/mitigation measures: None identified.

Risks/Assumptions: The habitat loss is considered precautionary, and where any works are to be undertaken detailed study would provide an accurate identification of whether habitat would be lost and the extent. The areas of potential habitat loss are small, but do not take into account accretion of sediments within the area and how this would influence the development of intertidal sandflat.

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**			
Menai Strait (Coastal – C8) (PDZ part 16, part 17and part 20) (MAN part 41, 42, 43, 44, 45, 46, 47 and 59)	N/A	✓	✓	✓	**No** - not necessary as delivery of the WFD Environmental Objectives will not be prevented by the SMP policies and in some cases will ensure they are of benefit.	**Yes (partly)** – One of the three relevant mitigation measures for this water body has been implemented, which then provides potential for one of the other measures to be put in place.	• **Managed realignment of flood defence -** MR within the following policies: **PU 16.4, 16.5, 16.11, 16.17** will allow the coastline to be more sustainable and adaptive to sea level rise. • **Removal of hard bank reinforcement -** could be implemented as part of the MR. • **Modify structure or reclamation.**
Conwy Bay (Coastal) (PDZ part 20) (MAN 59)	N/A	✓	✓	✓	**No** - not necessary as delivery of the WFD Environmental Objectives will not be prevented by the SMP policies and in some cases will ensure they are of benefit.	There were no relevant measures to the SMP2 for this water body.	N/A
Conwy (Transitional) (PDZ 20) (MAN 60, 61 and 62)	N/A	x (PDZ 20)	x (PDZ 20)	✓	**Yes** – Environmental Objectives WFD2 and 3 may not be met because of the SMP policy in PDZ20 (MANs 60 & 62).	**Yes (partly)** – One of the six relevant mitigation measures for this water body has been implemented, which then provides potential for other	• **Managed realignment of flood defence** - MR within the following: **PU 20.9, 20.18, 20.19** will allow the coastline to be more sustainable and adaptive to sea level rise. • **Removal of hard bank reinforcement -** could be implemented as part of the MR; **or replacement with soft engineering**

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**			
						measures to be put in place.	**solution.** • **Preserve ecological value of marginal habitat, banks and riparian;**

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**
Conwy (Transitional – T19) **PUs 20.3 – 20.10** (WFD 2) **PU 20.5** (WFD 3) **PUs 20.16 – 20.17** (WFD 2)	**Mitigation measures:** 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 required.	**RBMP mitigation measures incorporated into SMP policies:** • One of the mitigation measures in the Western Wales RBMP for this transitional water body is to be implemented through the SMP2 policies within PUs 20.9, 20.18 and 20.19, which will allow the coastline to be more sustainable and adaptive to sea level rise. The rivers banks will be able to accrete sediments along the foreshore, and thus improve the benthic invertebrate communities. This policy also has the potential to achieve one other mitigation measure, though this will depend on how the MR is determined, for example, removal of hard bank reinforcement for any obsolete structures. **Other potential mitigation measures that could be required:** • Develop a more sustainable coastal management plan/strategy for the estuary to take account the coastal processes and flood risk linkages between the open coast and the Conwy Estuary. • Undertake environmental monitoring of the designated sites. • Ensure the SMP2 policies and flood and erosion risks are accounted for in the next revisions of land use plans.
	Affect on other Water Bodies: can it be demonstrated that the preferred SMP policies do not permanently exclude or compromise the achievement of the objectives of the Directive in Water Bodies within the same River Basin District that	The Environment Agency Flood Map application, Groundwater maps and the Western Wales RBMP have been consulted to check for landward freshwater and groundwater bodies that potentially could be impacted by SMP2 policies. There are two FWBs that discharge into this TraC Water Body. It was considered that the mouth of the 'unnamed Conwy Estuary west (PU20.5)' river is constrained because of the SMP2 policy and has the potential to compromise the Environmental Objectives of the WFD for this river water body, by preventing GES being achieved. It is unlikely that the integrity or Ecological Status of the Gyffin River (PU20.6) will be compromised. The assessment also concluded

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
	are outside of the SMP2 area?	that the Conwy GWB will be not be impacted as a result of the SMP2 policies as there is no current evidence of saline intrusion (see **Assessment Table 3** and **Section K3.3**).
	Other issues: 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)?	The outer and part of the middle section of the estuary is designated as part of the Menai Strait and Conwy Bay SAC, with much of the estuary also being designated as the Aber Afon Conwy SSSI, which is of special interest for its marine and terrestrial invertebrate biology. The Habitats Regulations Assessment concluded that the HTL policies for PUs 20.3 to 20.10, and 20.16 and 20.17 would not result in causing an adverse impact on the integrity of the SAC.