

Thorn Island to Cleddau Bridge (19)



Recommendations:

Long Term Plan

This frontage comprises the southern bank of Milford Haven (Daugleddau) from the mouth of the estuary to Cleddau Bridge. Although the estuary has been heavily modified, there are few anthropogenic constraints on channel movement, and the resistant geology remains the main constraint. There are limited opportunities for managed realignment due to the geomorphology of the estuary and in general there are poor littoral linkages between the various sections of coast.

The plan is to minimise intervention along the currently undefended stretches of shoreline, but ensure that the coastal erosion and flooding risk is managed with respect to existing residential areas, critical assets and infrastructure, should they become at risk from coastal erosion or flooding. In some places, this may rely on private funding to maintain or upgrade defences/ structures, subject to obtaining the necessary consents, licences and approvals.

Location (Policy Unit)		Preferred SMP2 policy and proposed approach to implementing the Plan		
		0-20 years	20-50 years	50-100 years
19.1	Thorn Island to Angle Point	Allow the coast to evolve and retreat naturally through no active intervention to maintain the natural landscape and environmental features of this shoreline.		
19.2	Angle Bay (Angle Point to Sawdern Point)	No active intervention will allow the coast to evolve and retreat naturally with minimal interference. At Angle village due to the limited assets at risk, public coastal erosion and flood risk management funding is unlikely to be available to maintain/ upgrade existing defences. It is recommended that suitable adaptation measures are implemented to reduce the risk of flooding to residential and non-residential properties and assets (such as improved flood warning, flood protection measures, flood resilience measures or relocation of assets). Private landowners may wish to fund maintenance/ improvement of existing defences or adaptation measures subject to obtaining the necessary consents, licences and approvals. This policy will allow maintenance or realignment of the access road to the lifeboat station, public house and properties, as required.		
19.3	Sawdern Point to Pembroke River	This will allow the shoreline to evolve naturally and retreat through no active intervention to conserve existing natural landscape and environmental features. The risk to the oil refinery should be monitored, and intervention undertaken as necessary, to continue to manage the risk of coastal erosion to these assets and the potential risk of contamination of the Haven.		
19.4	Pembroke River	The policy is to allow the coast to evolve and retreat naturally through no active intervention , assuming that the Pembroke Barrage remains and is maintained, upgraded or replaced to reduce the risk of flooding to property, assets and infrastructure and traffic disruption within Pembroke. The barrage is currently vulnerable to overtopping during storm conditions. This policy would not preclude the existing defences at the power station jetty from being privately maintained, in order to continue managing flood and erosion risk to the power station and its assets. Any upgrading, extension or improvement to the defences would be subject to obtaining the necessary consents, licences and approvals.		
19.5	Pembroke River to Martello Tower, Llanreath	The policy is to allow the coast to evolve and retreat naturally through no active intervention .		
19.6	Martello Tower, Llanreath to Cleddau Bridge	Along this stretch there are a number of residential, commercial, amenity, retail and industrial facilities potentially at risk from flooding, particularly in response to future climate change/ sea level rise. The policy is therefore to hold the line through maintaining and upgrading the existing defences as required, subject to the future availability of public coastal erosion and flood risk management funding and obtaining necessary consents, licences and approvals. This would include any new defences built as part of the approved Martello Quays marina development. Future climate change/ sea level rise may result in an increased risk of surface water flooding to the lower parts of the town. There are potential surface water drainage issues at this frontage both currently and as a result of future climate change/ sea level rise. There is also a risk of tidal flooding from Cosheston Pill.		

A review of the impacts of the preferred SMP2 policies on coastal evolution and behaviour is provided in Appendix E: Policy Development and Appraisal, Section E1.3.

Policy sensitivities and key uncertainties (further detail is included in Appendix K)

Policy unit 19.3 - monitoring of the risk of coastal erosion to the oil refinery is required, and the policy could change locally if the risk increases.

Policy unit 19.4 – this is subject to the Pembroke Barrage being maintained, upgraded or replaced to provide a suitable standard of flood protection.

Policy unit 19.5 – monitor the risk of coastal erosion to existing residential developments at Pennar Park and Llanreath.

Policy unit 19.6 - there are a number of residential, commercial, amenity, retail and industrial facilities, historic dockyard and other associated historic features potentially at risk from flooding due to sea level rise. Much of the shoreline does, however, comprise dock and quay structures, which are not covered by public funding of coastal erosion and flood risk management. Therefore this policy is sensitive to the future strategy for these structures and availability of funds.

Changes from present management / SMP1 policy¹

For the majority of the coast the policies remain unchanged from either present management or the SMP1 policy.

Policy unit 19.2 - SMP1 recommended policies of hold the where there are existing defences, and to manage flood and erosion risk at Angle village. It is considered unlikely that this could be justified based on the value of socio-economic assets at risk, therefore adaptation is the recommended approach at Angle village.

¹ The SMP1 documents should be referred to for more details as unit boundaries do not always align with SMP2 policy units and the policies refer to different time periods.

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Issue	Appraisal
Receptor: Property, population and human health There are limited settlements along the western part of this frontage and with Angle village. East of the Pembroke River are Pennar Park, Llanreath and Pembroke Dock. The majority of the frontage is undefended, with localised defences adjacent to Angle village and the power station in the Pembroke River. The Pembroke Dock frontage is developed, and comprises various defences and dock structures.	
Will SMP policy maintain coastal settlements and manage the impact of coastal flood and erosion?	<ul style="list-style-type: none"> + The Plan will manage the risk of coastal erosion and flooding along this frontage. - At Angle village due to the limited assets at risk, public coastal erosion and flood risk management funding is unlikely to be available to maintain/ upgrade existing defences. It is recommended that suitable adaptation measures are implemented to reduce the risk of flooding to residential and non-residential properties and assets (such as improved flood warning, flood protection measures, flood resilience measures or relocation of assets). Private landowners may wish to fund maintenance/ improvement of existing defences or adaptation measures subject to obtaining the necessary consents, licences and approvals. - The barrage is currently vulnerable to overtopping during storm conditions. It has been assumed that the Pembroke Barrage remains and is maintained, upgraded or replaced to reduce the risk of flooding to property, assets and infrastructure and traffic disruption within Pembroke. - Pembroke Dock would only be protected by any new defences constructed as part of the approved Martello Quays development. Tidal flood risk from Cosheston Pill would remain.
Will SMP policy directly increase the actual or potential coastal erosion or flood risk to communities?	<ul style="list-style-type: none"> - Along the majority of this shoreline, the recommended policy is to continue existing coastal erosion and flood risk management. There will, however, be an increased risk of coastal erosion and flooding at Angle village and within Pembroke if the Barrage is not maintained/ upgraded or replaced.
Is SMP policy sufficiently flexible to take account of dynamic coastal change?	<ul style="list-style-type: none"> + The SMP policy recognises dynamic coastal change, with policies of no active intervention along much of the frontage. - There would be continued maintenance/ upgrading of existing defences at Pembroke Dock in order to manage the risk of coastal erosion and flooding to residential, commercial, amenity, retail and industrial facilities.
Could there be a detrimental impact on the fabric of coastal communities?	<ul style="list-style-type: none"> x Along most of this shoreline, there will be no impact on coastal communities due to the undeveloped nature of the shoreline. - Increased risk of coastal erosion and flooding at Angle village which will affect the main village road, residential and non-residential properties and assets and will have an impact on the wider community in terms of loss of community assets, difficulties in insuring properties and depreciation in property value.
Receptor: Land use, infrastructure and material assets As well as the settlements, there are a number of key industrial assets along this frontage, including Rhoscrowther oil refinery, Pembroke Power Station and assets within Pembroke Dock. This includes industrial areas, residential facilities and tourism assets. There is also a lifeboat Station and jetty just west of Angle Point.	
Will SMP policy maintain key industrial, commercial and economic assets and manage the impact of coastal flooding and erosion?	<ul style="list-style-type: none"> + Although the recommended Plan for the coastline west of Pembroke Dock is to allow the coastline to evolve naturally through no active intervention, risk to key assets such as the oil refinery and power station would be monitored and intervention undertaken if necessary. It is also assumed that the road to the lifeboat station would be maintained/ realigned as required in order to allow continued operation of this facility. + Defences along the Pembroke Dock frontage would be maintained and upgraded in order to manage coastal erosion and flood risk to key assets.
Will the SMP policy ensure critical services and infrastructure remain operational, for as long as required?	<ul style="list-style-type: none"> + SMP policy would ensure that coastal erosion and flood risk to key infrastructure would continue to be managed. - There will be increasing flood and erosion risk to local services at Angle, as defences fail and sea level rises. Many of these assets would, however, be lost at the same time as the properties they serve. x No risk to Angle Bay or Hundleton Sewage Works due to their location inland of the flood and erosion risk zone. + It is assumed that the Cleddau Bridge and associated structures would be maintained in order to retain the A477.
Will there be an impact on marine operations and activities?	<ul style="list-style-type: none"> + It is assumed that dock and quay structures at Pembroke Dock would continue to be maintained and upgraded as required to remain operational. These are not covered by flood and defence funding, and are the responsibility of the port authority. The road to the lifeboat station at Angle would also be maintained/ realigned as required in order for the lifeboat services to remain operational.

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Will SMP policy impact coastal flooding or erosion on agricultural activities?	<ul style="list-style-type: none"> - Risk of loss of small areas of cliff top agricultural land, although this would be dependent on future rates of coastal erosion. Areas lost would not be expected to be significant.
Will the SMP policy ensure that MoD (Qinetiq) ranges remain operational?	<ul style="list-style-type: none"> x There are no MoD (Qinetiq) assets along this shoreline.
Receptor: Amenity and recreational use Although parts of Milford Haven are a popular tourist destination, there are limited amenity facilities along this frontage. The shoreline west of Rhoscrowther oil refinery is in the Pembrokeshire National Park and the Pembrokeshire Coast Path follows the shoreline along much of its length. There are tourist and recreational facilities in Pembroke Dock including accommodation, caravan parks and boat trips.	
Could the SMP policy have an impact on tourism in the area?	<ul style="list-style-type: none"> + The risk of coastal erosion and flooding to tourist amenities and facilities in Pembroke Dock will continue to be managed through maintenance and upgrading of existing defences. + The remainder of the coast will be allowed to remain undisturbed, thereby maintaining the natural landscape, which is a key element of the tourist interest.
Will SMP policy affect coastal access along, or to, the coast?	<ul style="list-style-type: none"> - There is a small risk to the coastal footpath, due to cliff erosion or localised cliff falls. This risk is expected to increase over time. There is potential for the footpath to be relocated or realigned slightly inshore, if there is sufficient notice. There may also be access issues at Angle as defences fail.
Receptor: Historic environment There are a range of cliff top forts and military remains that are designated Scheduled Monuments. These include Chapel Bay Fort, Fort Popton and West Pennar Camp. At Pembroke Dock there are a number of listed buildings associated with the historic dockyard and there are wrecks on the foreshore. Local archaeology includes extensive military coastal defence evidence, Angle village and associated Medieval settlement and agricultural landscape.	
Will SMP policy maintain the fabric and setting of key historic listed buildings, cultural heritage assets and conservation areas?	<ul style="list-style-type: none"> - There is a risk of coastal erosion to Scheduled Monuments on the cliff top, although the risk is considered minimal and is dependent on future rates of coastal erosion. As these are located on undeveloped frontages, the recommended policy is to allow continued natural erosion. - Foreshore wrecks are at risk of erosion or submergence. The level of risk is dependent on future rates of coastal erosion or sea level rise. + Historic assets within Pembroke Dock would be maintained.
Will the SMP provide sustainable protection of archaeological and palaeo-environmental features or ensure adequate time for monitoring, assessment and mitigation measures to be devised in response to ongoing and future erosion.	<ul style="list-style-type: none"> o Along currently undefended frontages there is no intent to provide new defences, as this would not be socio-economically justified and is considered unsustainable. However, coastal erosion rates tend to be low which should allow time for monitoring, assessment and mitigation measures to be developed and implemented, where appropriate. + At Pembroke Dock, there would be no risk to archaeological assets.
Receptor: Landscape character and visual amenity The shoreline west of Rhoscrowther oil refinery is within the Pembrokeshire Coast National Park, noted for its spectacular landscape of rugged cliffs, sandy beaches, wooded estuaries and wild inland hills. East of the Pembroke River, the landscape is more industrial in nature.	
Will SMP policy maintain a range of key natural, cultural and social features critical to the integrity of the coastal landscape?	<ul style="list-style-type: none"> o For much of this shoreline there is no proposed change from the existing policy, therefore minimal change to the landscape, particularly in the short term. - A policy of no active intervention at Angle Bay may adversely affect the visual landscape locally, as defences deteriorate and fail. The only requirement to remove the remains of defences would be if they represented a health and safety risk.
Could SMP policy lead to the introduction of features which could be unsympathetic to the character of the landscape?	<ul style="list-style-type: none"> + There is no intent to provide any additional defences.
Receptor: Biodiversity, flora and fauna Pembrokeshire Marine Special Area of Conservation (SAC) and Milford Haven Waterway SSSI cover the length of the coastline.	
Will SMP policy enable a sustainable approach to habitat management?	<ul style="list-style-type: none"> + There are no new defences proposed in currently undefended areas, therefore this is considered a sustainable approach to natural evolution of the coastline and its habitats.
Will SMP policy maintain or enhance any international, national or local sites of natural conservation interest?	<ul style="list-style-type: none"> o There could be natural loss of cliff top and cliff face habitats, designated as part of many of the designated sites, but the low rates of coastal erosion mean that losses are likely to be small. Newly exposed cliff faces could be colonised by interesting new species. o As sea level rises, there would be natural intertidal narrowing, leading to submergence and loss of habitat, particularly where resistant cliffs prevent retreat.
Will SMP policy <u>accelerate</u> intertidal narrowing (coastal squeeze) and will this affect designated habitats?	<ul style="list-style-type: none"> - There may be intertidal narrowing, i.e. coastal squeeze, at Pembroke Dock, and in the short term at Angle village where although localised defences would not be maintained they would be expected to remain in place for some years. + However, the intent of the Plan is to allow the majority of the coast to evolve naturally, with no artificial backshore constraints. In places natural intertidal narrowing may still occur as the resistant cliffs may not retreat at the same rate as the sea level rises. This is dependent upon future rates of sea level rise.
Will there be a net loss of BAP habitat within the SMP timespan as a result	<ul style="list-style-type: none"> + Extension of seagrass beds in the short, medium and long term due to

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of SMP policy?	<p>the natural evolution of the coastline.</p> <ul style="list-style-type: none"> - Loss of intertidal habitat between Martello Tower, Llanreath to Cleddau Bridge in the short, medium and long term due to the provision of defences.
Receptor: Earth heritage, soils and geology Pembrokeshire Marine Special Area of Conservation (SAC) and Milford Haven Waterway SSSI cover the length of the coastline.	
Does SMP policy work with natural processes and enhance or maintain natural features?	<ul style="list-style-type: none"> + The SMP plan is for no active intervention along this shoreline, thereby working with natural coastal processes, except for at Pembroke Dock where there are few exposures due to the developed nature of the shoreline, and therefore maintaining/ upgrading existing defences would not adversely affect designated features.
Will SMP policy maintain or enhance the visibility of coastal geological exposures, where designated?	<ul style="list-style-type: none"> + Where the shoreline is currently undefended, there is no intention to build new defences, therefore geological exposures in the cliffs will be maintained, which will maintain much of the geological interest. • Sea level rise may, in the long term, reduce visibility of foreshore exposures and result in submergence of sea caves.
Receptor: Water There are numerous coastal, freshwater, transitional (areas of water near river mouths, which are partially saltwater but are influenced by freshwater) and groundwater bodies in the SMP2 area that have the potential to be affected by SMP2 policies.	
Will SMP policy manage the risk of pollution from contaminated sources?	<ul style="list-style-type: none"> + The Plan is to manage risk of contamination through maintaining existing defences at Pembroke Dock, and undertaking intervention if necessary at the power station and Rhoscrowther oil refinery.
Will SMP policy adversely affect water bodies in the coastal zone?	<ul style="list-style-type: none"> • The Milford Haven Outer and Milford Haven Inner water bodies will not be significantly affected as a result of primarily NAI. At Pembroke Dock (PU19.6) HTL may exacerbate intertidal narrowing where there are sand and mud flats. However, the intertidal habitat extents are already very limited, and thus any effect will not be significant for water body status or WFD objectives. • The Pembrokeshire Carboniferous Limestone groundwater body and river water bodies will be unaffected.

Impact colour key	+ Positive	• Neutral	- Negative	x Not applicable
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Thorn Island to Cleddau Bridge (19)						
ACTION PLAN						
Action	Action Ref	Policy Unit	Action Description (to be approved)	Potential source for funding (subject to approval)	Responsibility Lead partner * (supporting partners)	When by (subject to funding)
1. Studies for Scenario Area	1.1	All	Develop a long term sustainable plan for the Pembrokeshire Coast Path to identify sections which are currently at risk from coastal erosion/ flooding and those which are likely to be at risk in future under a range of future climate change/ sea level rise scenarios. Develop adaptation/ mitigation measures to maintain a continuous coastal footpath.	WAG	PCC/ PCNPA	0 to 20 years
2. Studies for Policy Units	2.1	19.2	Undertake assessment of the future risk of coastal erosion and flooding at Angle Bay to inform the development and assessment of alternative adaptation measures to existing properties and assets which may include improved flood warning, flood protection measures, flood resilience measures or relocation of assets. Community engagement will be undertaken to identify alternative coastal erosion and flood risk management options (including wide ranging adaptation options) and alternative funding options where it is not possible to justify public investment in coastal erosion and flood risk management.	WAG	PCC (EAW)	0 to 5 years
	2.2	19.4	Undertake a feasibility study for Pembroke Barrage to identify and assess the technical, environmental and socio-economic impacts of alternative options for providing a suitable standard of protection in response to future climate change/ sea level rise to reduce the risk of property flooding and traffic disruption within Pembroke. Consider alternative funding options where it is not possible to justify public investment in coastal erosion and flood risk management.	WAG	PCC (EAW)	0 to 20 years
	2.3	19.6	Undertake a scoping assessment to identify when a feasibility study on the upgrading/improvement options to existing defences needs to be carried out and/or identify the criteria/factors that would trigger this feasibility study. The timing of this feasibility study will be influenced by factors such as: existing frequency of flooding, type of receptors at risk, depths and velocity of flooding and residual asset life. Consider alternative funding options where it is not possible to justify public investment in coastal erosion and flood risk management.	WAG	PCC (EAW)	0 to 20 years
	2.4	N/A	To inform future management and the development of the second generation CFMP (current downstream boundary of the CFMP is at the Cleddau Bridge) if recommended, a study of the current and future risk of flooding to properties, assets and land upstream of the Cleddau Bridge from various sources is undertaken to include a range of future climate change scenarios. This work is outside the boundaries and scope of the SMP2.	WAG	EAW (PCC)	0 to 20 years
3. Strategy						
4. Scheme work						
5. Monitoring (data collection)	5.1	All	Undertake beach and coastal defence asset monitoring to inform future studies and SMP reviews. In particular, cliff erosion rates should be monitored. This information should not only be used in future coastal management, but also to assist in stakeholder liaison by use of data in public education campaigns.	WAG	PCC (Wales Coastal Monitoring Centre)	0 to 100 years
	5.2	All	Extend current beach profile monitoring programme which is currently undertaken between Lavernock Point and St Govan's Head to cover this shoreline and provide information to the Wales Coastal Monitoring Centre for storage and analysis. Use beach profile data to identify the future risk of undermining and overtopping of existing defences.	WAG	Coastal Group (Wales Coastal Monitoring Centre)	0 to 100 years
	5.3	All	Undertake periodic defence inspection, including condition assessment and photographs, Confirm defence crest levels.	WAG	PCC (Wales Coastal Monitoring Centre)	0 to 100 years
	5.4	All	Undertake further studies, and associated modelling, to better understand sediment regimes in the SMP area and inform future coastal management.	WAG	Coastal Group	0 to 20 years
	5.5	All	Monitor risk to the coastal footpath and investigate potential re-routing of the path where appropriate.	WAG	PCC	Ongoing
	5.6	19.3	The risk to the oil refinery should to be monitored, and intervention undertaken as necessary, to continue to manage the risk of coastal erosion to these assets and the potential risk of contamination of the Haven.	Private	Private	0 to 20 years
	5.7	19.5	The risk to Pennar Park and Llanreath should to be monitored, and intervention undertaken as necessary, to	WAG	PCC	0 to 20 years

			continue to manage the risk of coastal erosion to these assets and the potential risk of contamination of the Haven.			
6. Asset management	6.1	All	Ensure that extents of public and privately owned defences are defined and mapped to inform future management decisions.	WAG	PCC (Wales Coastal Monitoring Centre)	0 to 20 years
	6.2	All	Undertake an appraisal of asset inspection and beach profile monitoring data to assess the existing and future risk of undermining and overtopping of existing structures.	WAG	PCC (Wales Coastal Monitoring Centre)	0 to 20 years
7. Communication	7.1	All	Undertake consultation with the local community, key stakeholders and general public during the development of alternative solutions and whenever appropriate to ensure an acceptable approach is developed and adopted.	WAG	PCC (PCNPA)	0 to 20 years
	7.2	All	Undertake monitoring and management of Action Plans to ensure SMP policies are put into practice.	WAG	Coastal Group	0 to 100 years
8. Interface with planning and land management	8.1	All	Continue with risk-based improvements to flood risk maps to provide an appraisal of likely future projected sea level rise.	WAG	EAW	0 to 20 years
	8.2	All	Ensure SMP policies and flood and erosion risks are accounted for in the next revisions of land use plans in order to help manage residual risks from coastal erosion and flooding, and to inform future planning decisions.	WAG	PCC planning/ PCNPA	0 to 20 years
	8.3	All	Establish an officer working group in order to consider the possible effects of sea level rise on the transport infrastructure of Pembrokeshire in order to identify specific vulnerabilities and possible mitigation. The group should identify the time scale for such impacts under a range of sea level rise values from 0.5m to 2m and make recommendations as to mitigation and adaptation measures.	WAG	PCC/ PCNPA	0 to 20 years
9. Emergency response	9.1	19.2, 19.5 & 19.6	Development, monitoring and review of emergency response plans to prepare for storm events which are likely to exceed existing defence standards of protection or lead to failure of existing defences (for example following breach or overtopping).	WAG	PCC	0 to 20 years
10. Adaptation/ resilience			-			
11. Flood forecasting and warning	11.1	All	Continue with risk-based improvements to flood risk maps and inundation modelling to provide improved flood warning service.	WAG	EAW	0 to 20 years
12. Habitat creation and environmental mitigation	12.1	All	Welsh Assembly Government instructed Environment Agency Wales to scope out the scale of potential coastal habitat gains and losses for Wales. The scoping exercise was completed in February 2011 and identified potential options for implementation of a National Habitat Creation Programme for Wales. How this programme is to be delivered and funded has yet to be decided.	WAG	TBC	Ongoing

* Note: It is recommended that the lead partners investigate the potential for local partnerships and alternative sources of funding.