

Managing flooding in Pwllheli

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Introduction

Natural Resources Wales is working to find long-term flood risk management solutions for the community of Pwllheli, alongside delivering wider environmental, social and economic opportunities.

Parts of Pwllheli are at risk of flooding from rivers and the sea. It is anticipated future flood risks, particularly from the coast, could be significant.

As our climate changes, we will face more frequent storms, as well as rising sea levels. This will put increased pressure on flood defences and could impact how they perform. Maintaining today's level of flood protection for people and homes is a challenge.

This is a significant project addressing the challenges of managing flooding from both rivers and the sea. We are continuing to explore options to more effectively manage the long-term flood risk to Pwllheli and surrounding communities.

The work builds on previous projects and involves assessing a range of long-term options to reduce the risk of river and sea flooding to the local community. We have taken into account a range of factors for the options we are considering such as sustainability, viability, and affordability.

We are committed to working with nature and exploring opportunities to create new habitats, improve the biodiversity in the area and provide wider benefits for the local community.

Since the last consultation the team has been working to assess the longlist options and develop a shortlist to take forward. We want to work together to find solutions that can offer a sustainable future for Pwllheli.

The wider context

Shoreline Management Plans (SMP2s) are policy responses to environmental changes. They provide the framework for managing the long-term impact of tidal flooding across Wales.

They break the coastline down into smaller sections known as 'policy units' and explain how each unit should be managed in the short, medium, and long term, taking into account the sustainability of flood risk management activities and assets and priorities for flood protection.



Coastal Squeeze

Where man-made structures have been built to protect communities and land from coastal flooding and erosion, such as sea walls or rock revetments, the habitat may be prevented from moving landward as sea levels rise whilst it continues to be lost from the lower shore. This is known as 'coastal squeeze'.

Coastal squeeze means that the saltmarsh size and function is reducing over time, along with the habitats and species that it supports.

A lot of saltmarsh habitat is legally protected therefore we are required to create new saltmarsh to offset losses in the future with sea level rise.



Livelihoods

Landowners and farmers may have noticed that the environment is changing and we want to hear your adaption concerns and ideas.



Natural Environment

The study area forms an important blend of coastal and wetland habitats that act as green corridors into surrounding countryside.

The environmental importance of this area is reflected in the large number of protected habitats and species.

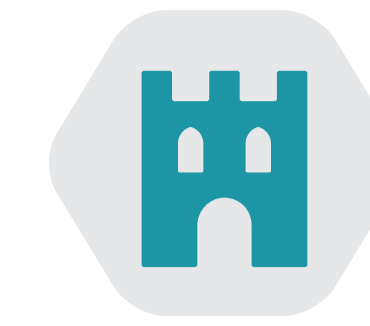
Many of these are of National and International importance and these too are being threatened by the effects of flooding and climate change.



Recreation

This study area offers many opportunities for diverse recreational pastimes.

These too will be carefully considered, as they are of vital importance for people's health and wellbeing, and also bring income to the community.



Historic Environment

The area surrounding Pwllheli has a long and fascinating history. Pwllheli itself has been a settlement since the 13th Century with a strong association with the sea, having been the main fishing port of the Llyn.

The coastline here has however changed considerably over time. Over the last 150 years there has been significant human intervention and development. These actions will have affected the shoreline development during this period and will continue to do so into the future. For example, the construction of the railway enclosed the marsh areas along the east coast, and in doing so has restricted any landward movement of the dunes themselves. There have been extensive changes to the Pwllheli South Beach, with land reclamation having taken place during the 19th century. The railway was extended across the north quay to Pwllheli in 1910, which effectively fixed the position of the shoreline at Pwllheli itself.

In 1813 the Pwllheli embankment (Embankment Road) and tidal flood gates were constructed connecting the main town with the South Beach. This created the basic structure of the inner and outer harbour that exist today as well as having a marked impact on how the land west of here has adapted.



Landscape

The outstanding natural beauty of the area with its close association with the Eryri National Park needs careful consideration when project planning.

Our work in the area

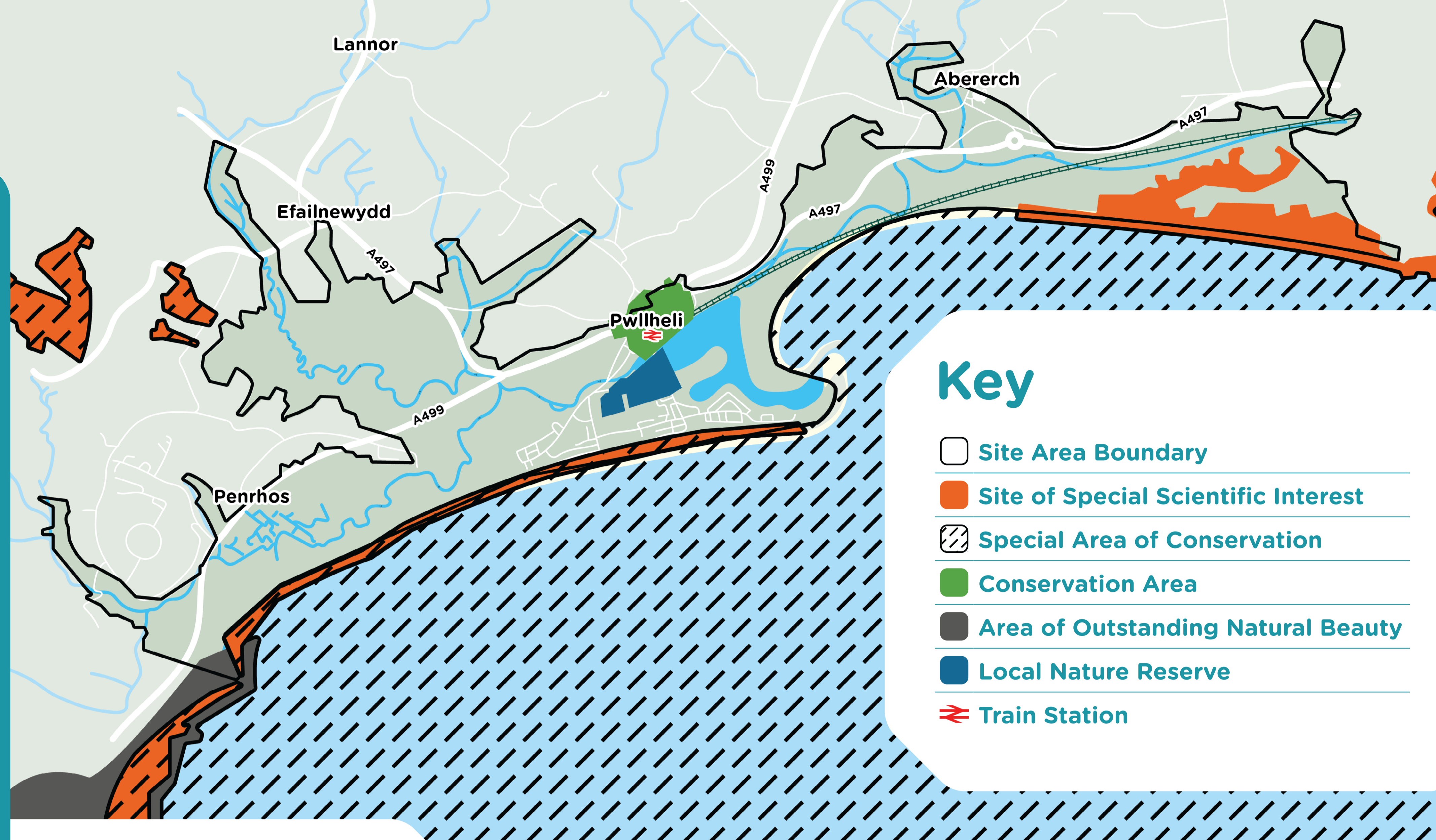
Natural Resources Wales is Wales's largest environmental body.

As well as managing flood risk, we have many legal duties and responsibilities to ensure we protect the outstanding environment we live in both now and in the future.

To achieve this, we have started carrying out a number of specialist surveys to help us understand the current state of nature.

We call this our baseline. Environment assessments will be used to ensure that all necessary approvals are in place for any work we carry out.

We must: protect the natural and historic environment, use natural resources in a sustainable way, seek ways to avert the Climate and Ecology Emergencies.



Key

- Site Area Boundary
- Site of Special Scientific Interest
- Special Area of Conservation
- Conservation Area
- Area of Outstanding Natural Beauty
- Local Nature Reserve
- Train Station

The Project

We have created a computerised flood model to calculate potential flood extents and water depths from storms.

We are using this to understand the problem at Pwllheli and have carried out environmental surveys as part of evidence gathering.

We have been assessing a Long List of options to reach a proposed Short List, prioritising flood risk reduction to people and homes.

Outside the project scope, but ongoing

- We inspect, operate and maintain flood defences working with asset owners and other organisations.
- We fulfil conservation and regulatory duties to protect the environment.
- We currently maintain the three main rivers entering Pwllheli (Erch, Penrhos & Rhyd-hir)
- We issue flood alerts and flood warnings for the coast, as well as fluvial flood warnings for the Erch and the Rhyd-Hir.
- We will continue to perform our ongoing response functions during a flood.

Flood defence structures

Several flood defences exist in the Pwllheli study area. These include embankments, harbour wall and mechanical gates at key locations.

Through this study, we are developing our understanding of the flood risk and the function of the defences so we can continue to protect homes and businesses in the long-term.



Afon Erch - Embankment



Abererch Dunes & Piles



Ffordd y Cob Embankment



Afon Erch Tidal Doors



Carreg y Defaid Sea Defences



Dunes with Rock Armour by Golf Course



Rhyd-hir flood wall

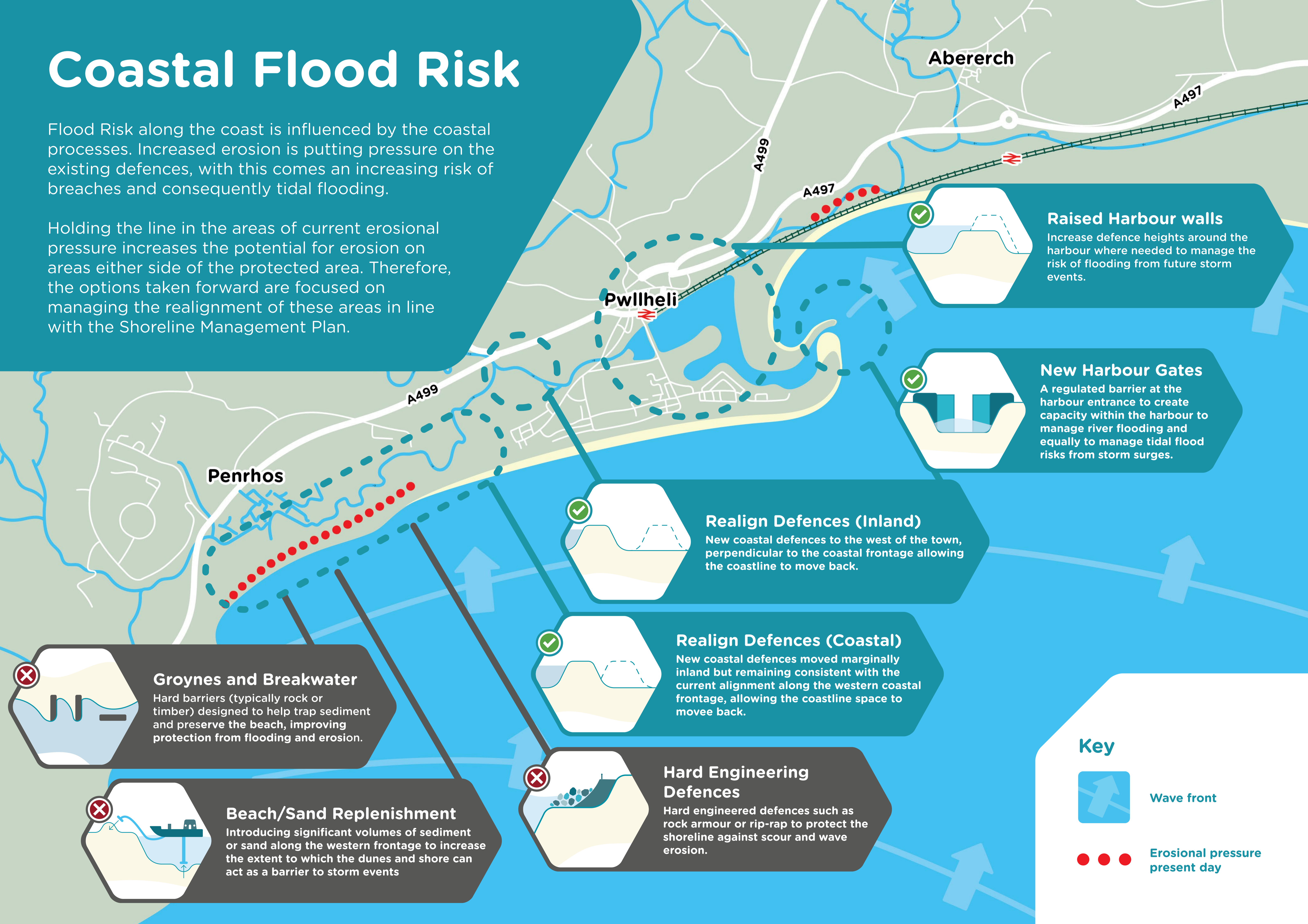


Rhyd-hir Tidal Doors

Coastal Flood Risk

Flood Risk along the coast is influenced by the coastal processes. Increased erosion is putting pressure on the existing defences, with this comes an increasing risk of breaches and consequently tidal flooding.

Holding the line in the areas of current erosional pressure increases the potential for erosion on areas either side of the protected area. Therefore, the options taken forward are focused on managing the realignment of these areas in line with the Shoreline Management Plan.



Raised Harbour walls
Increase defence heights around the harbour where needed to manage the risk of flooding from future storm events.



New Harbour Gates
A regulated barrier at the harbour entrance to create capacity within the harbour to manage river flooding and equally to manage tidal flood risks from storm surges.



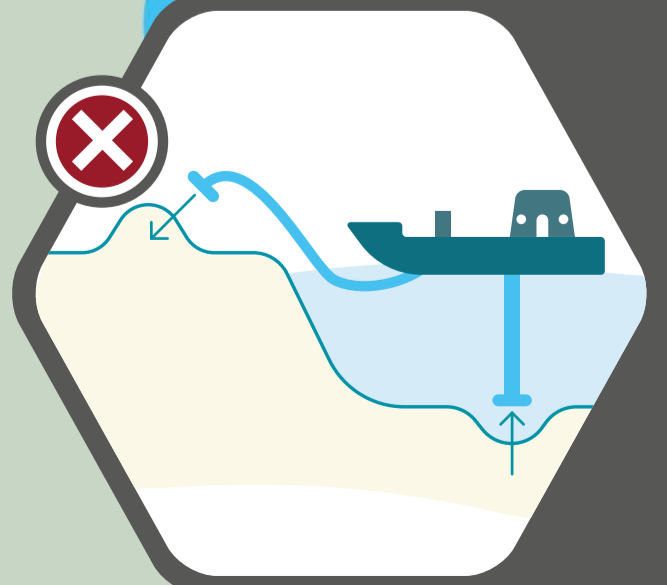
Realign Defences (Inland)
New coastal defences to the west of the town, perpendicular to the coastal frontage allowing the coastline to move back.



Realign Defences (Coastal)
New coastal defences moved marginally inland but remaining consistent with the current alignment along the western coastal frontage, allowing the coastline space to move back.



Groynes and Breakwater
Hard barriers (typically rock or timber) designed to help trap sediment and preserve the beach, improving protection from flooding and erosion.





Beach/Sand Replenishment
Introducing significant volumes of sediment or sand along the western frontage to increase the extent to which the dunes and shore can act as a barrier to storm events



Hard Engineering Defences
Hard engineered defences such as rock armour or rip-rap to protect the shoreline against scour and wave erosion.

Key

-  Wave front
-  Erosional pressure present day

Flood risk from rivers - West

There are several watercourses and areas of interest to the west of Pwllheli. Here three main rivers the Afon Rhyd-hir, the Afon Penrhos and Afon Ddwryd merge as they approach the western edge of Pwllheli. They continue towards the town as the Afon Rhyd-hir which enters the harbour through tidal gates below Embankment Road.

Flood risk from these watercourses primarily arises from the rivers becoming “tide-locked” when the gates close during high tides. When this coincides with high river flows from prolonged or heavy rainfall, water levels in the rivers increase, overflowing into the surrounding floodplain. This can result in flooding to people, property and the A499.

These are additional options that will be taken forward for consideration in conjunction with the main options that are shortlisted.

Localised Road Raising

Increasing the height of the roads above predicted flood levels to lessen risk of road closures through flooding.

Natural Flood Management

Natural Flood Management (NFM) is when natural processes are used to reduce the risk of flooding through restoring bends in rivers, changing the speed water flows in rivers and the way land is managed so soil can absorb more water.

Property Flood Resilience

Property Flood Resilience (PFR) are measures that can help to prevent flood water ingress into a building or aid rapid recovery following a flood event.

Dredging

Significant ongoing dredging and channel reprofiling of the rivers to improve flows and capacity.



Upstream Storage
Introducing changes in the upstream land to create greater capacity for flood water to be stored there.



River Diversion
A reprofiling of the gradient of the rivers so that it diverts flows to the coast at a new location west of the town.



New Harbour Gates
A regulated barrier at the harbour entrance to create capacity within the harbour to manage river flooding and equally to manage tidal flood risks from storm surges.



Overpumping on the Afon Rhyd-hir and Afon Penrhos
High volume pumping stations to be constructed in Pwllheli, designed to pump high river flows to the sea when high tides would otherwise cause a backing up effect.



New Flood Defences
Localised defences within the town centre where they can provide direct protection from river flooding.

Flood risk from rivers - East

To the east of Pwllheli the Afon Erch flows from Abererch village towards the town. This river enters the harbour on its eastern side, after passing through the tidal gates adjacent to Abererch Road. The main area of flood risk from the Afon Erch is within Abererch village.

There are existing flood defence structures here including an embankment which helps to protect the village. However, there remains a flood risk from over topping of the banks in extreme events which could become more frequent with climate change.

These are additional options that will be taken forward for consideration in conjunction with the main options that are shortlisted.

Natural Flood Management

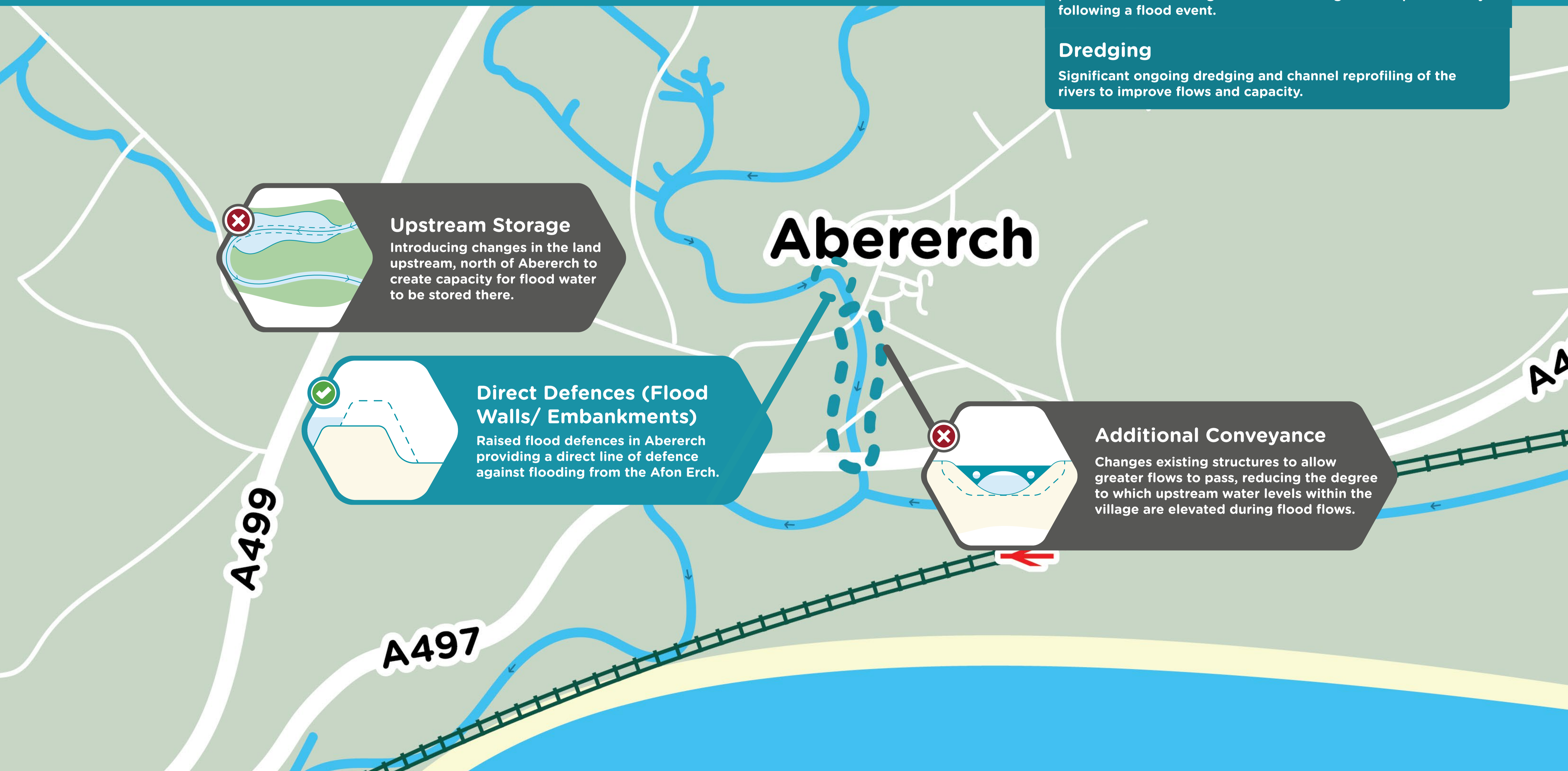
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Appraising the options



Critical Success Factors

These are the project outcomes that are crucial to the successful delivery of the project and differ from the Objectives which identify aspirational outcomes.

Strategic Fit

The option should substantially reduce flood risk from sea and main rivers. It should align with the relevant flood risk management strategies, policies, guidance and deliver wider benefits to the locality.

Potential Value for Money

The option should achieve a positive cost benefit ratio. It should deliver efficiencies and minimise costs associated with future maintenance and operational requirements.

Supplier Capacity and Capability

The option must match the capacity and capability of potential suppliers to deliver it.

Potential Affordability

The option must meet the requirements and deliver outcomes to be eligible for funding via Welsh Government Flood Risk Management Grant in Aid. The option should consider opportunities to provide benefits to potential funding partners.

Potential Achievability

The option must be physically possible to construct within the constraints in the area. The relevant consents and permissions must be securable. The Risk Management Authority must be able to meet the long-term management and maintenance needs of the option.






Investment Objectives









































































































The project investment objectives have been established through early dialogue with stakeholders and are presented in the following table. These investment objectives are aspirational and set out 'where we want be' or 'what we want to achieve' and are not so narrowly defined so that they set limits on what is possible.

- 1 Anticipate the effects of climate change and seek to reduce the flood risk and impact to properties, transport infrastructure and risk to life associated with fluvial and tidal flooding from the Erch, Rhyd-hir and overtopping and breaching of Pwllheli's Coastal frontage.
- 2 Increase performance of the existing flood defences and control structures, including reducing the short to long-term operational maintenance and health and safety liabilities.
- 3 Understand evolution of coastal processes and the timeframe and trigger points for SMP policy implementation. Put forward solutions that will deliver against the SMP2 policies for the various Pwllheli frontage sections that will be adaptable to wider strategies set out by NRW and GC.
- 4 Seek to deliver a flood risk solutions that can demonstrate delivery against SMNR principles and benefits. Supporting Welsh Government climate and biodiversity emergency priorities.
- 5 Seek to maintain and enhance biodiversity and ecosystem resilience, through working with Natural Flood Management (NFM) and identifying wider opportunities in the catchment.
- 6 Through effective engagement consider the needs and views of the local community and stakeholders.
- 7 Seek to support amenity and regeneration in Pwllheli and where possible enhance, natural, historic, visual and built environments in order to support local culture and the Welsh language.
- 8 Seek to promote sustainable management of the dunes (a priority habitat), whilst improving access and improving social and recreational cohesion.
- 9 Identify options within a 'Coastal Adaptation Plan' for habitat creation, restoration and enhancement in support of Sustainable Management of Natural Resources (SMNR) and conservation priorities.
- 10 In conjunction with the public and stakeholders, support the planning and communication of a 'Coastal Adaption Plan' for the western and eastern Pwllheli coastal flood plain.

Longlist Options Appraisal

Key

-  Confidence that the option could achieve the Critical Success Factor, although further development is required.
-  The option needs further development to understand whether it could achieve the Critical Success Factor.
-  There is appropriate understanding to confidently conclude that the option would not achieve the Critical Success Factor.

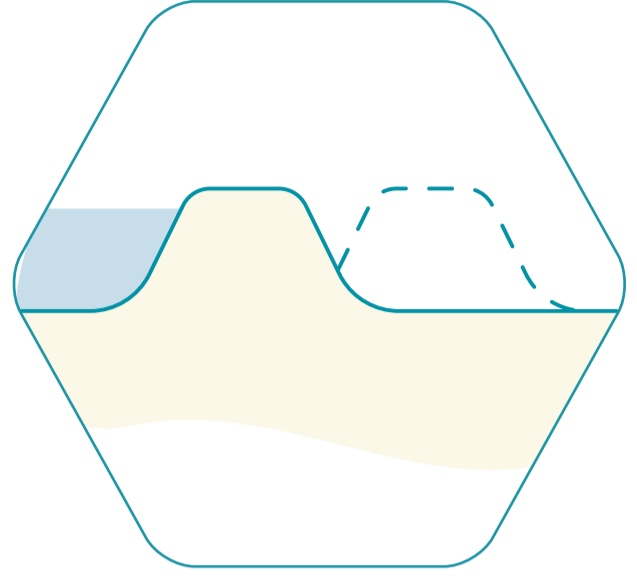
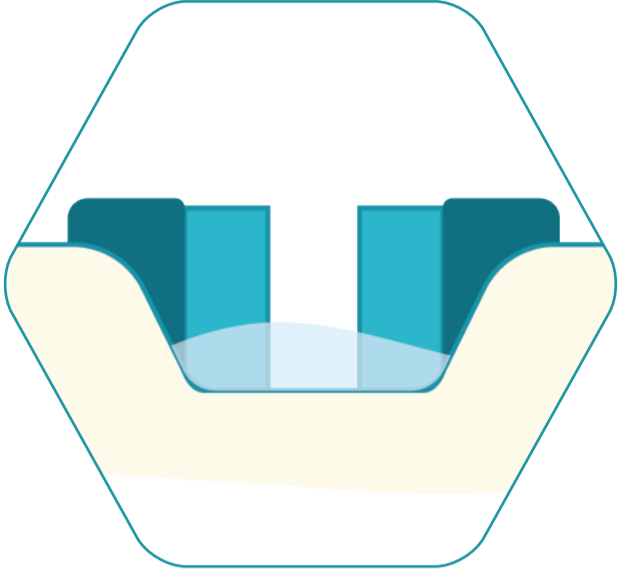
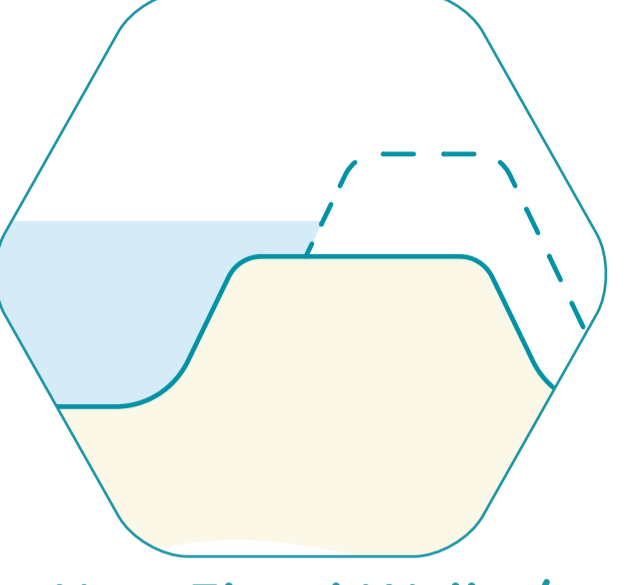
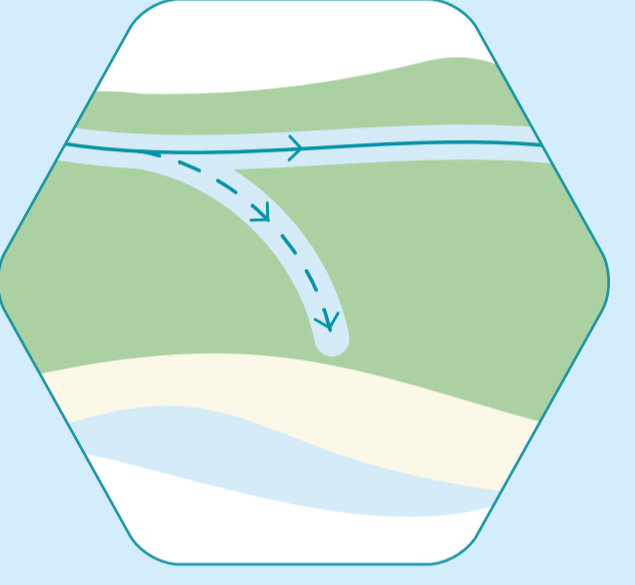
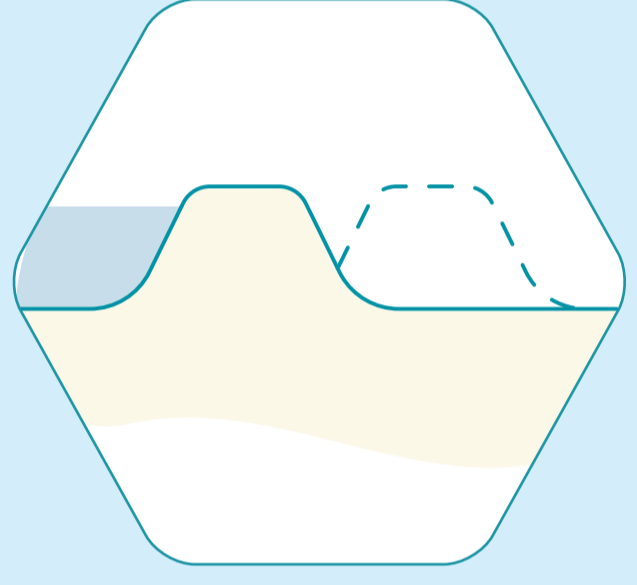
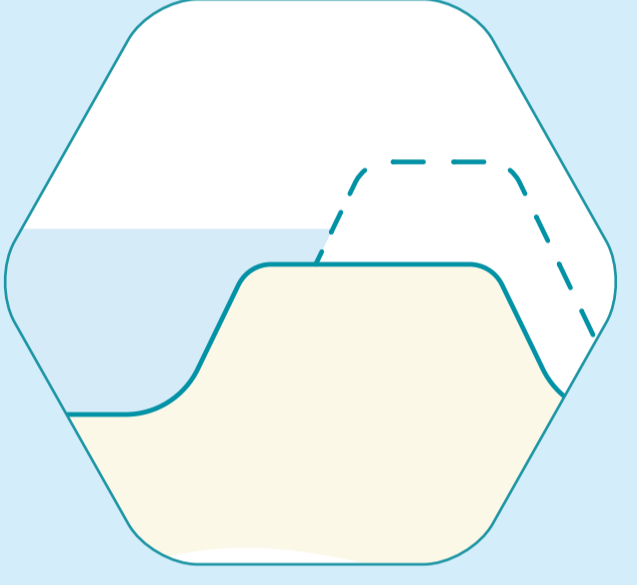
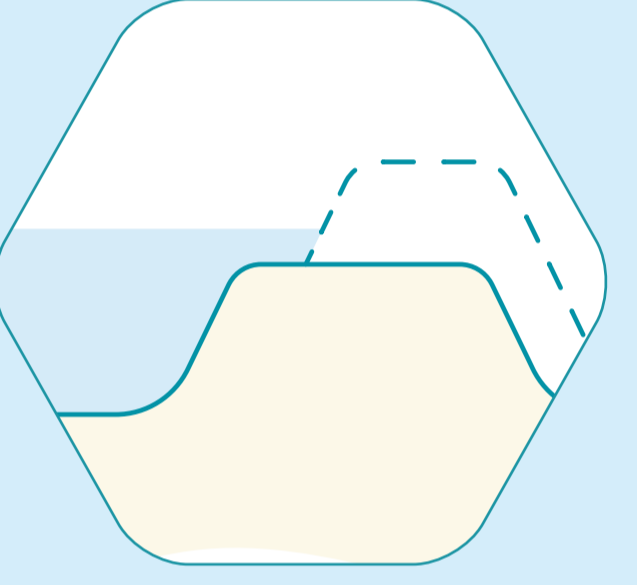
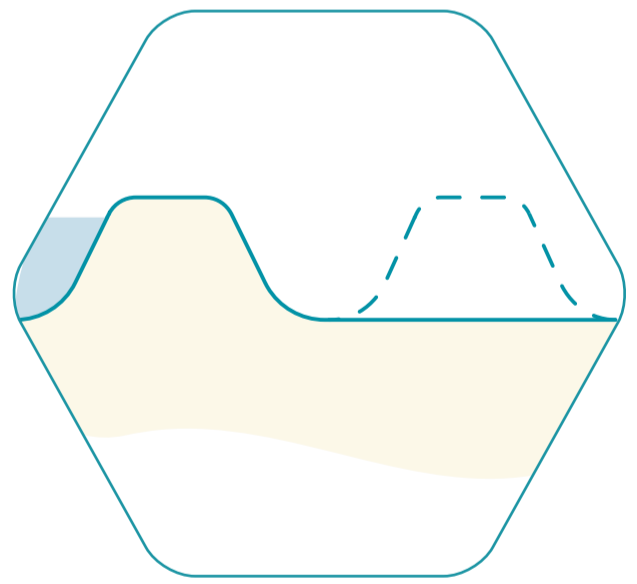
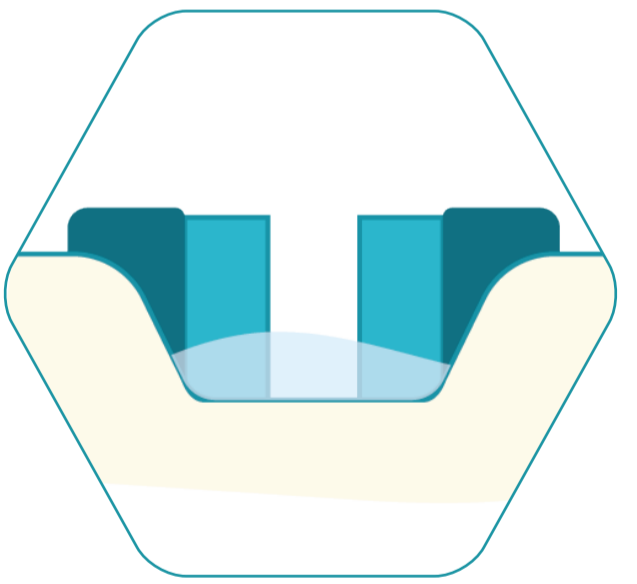
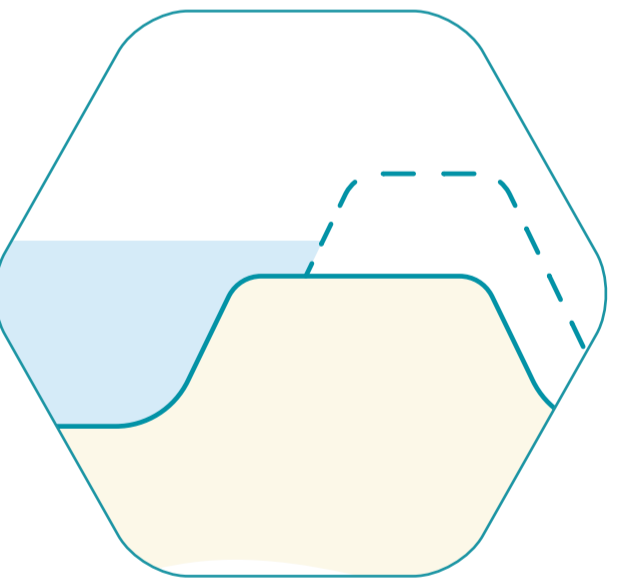
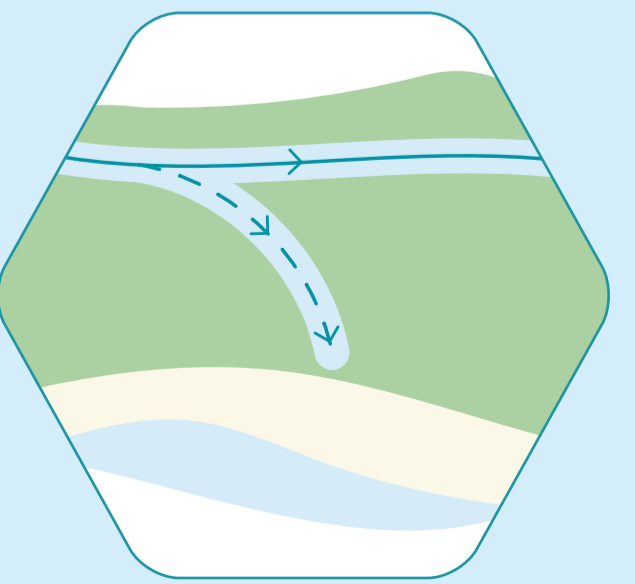
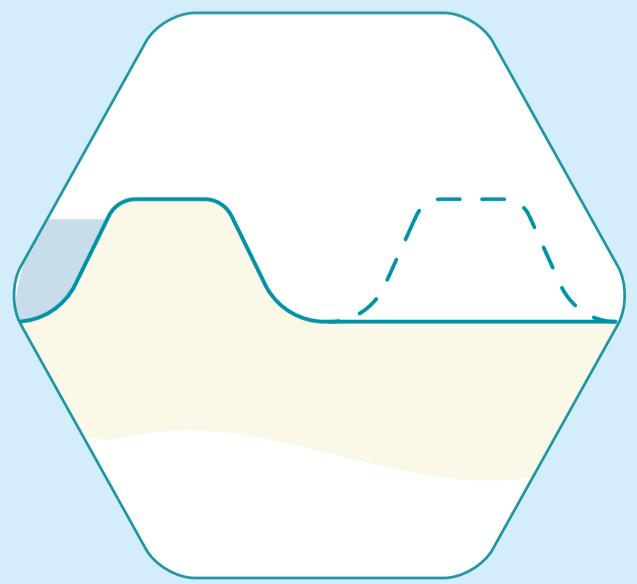
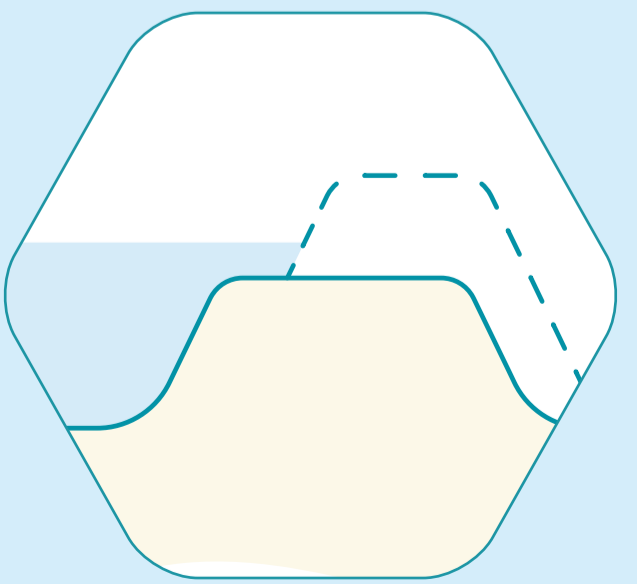
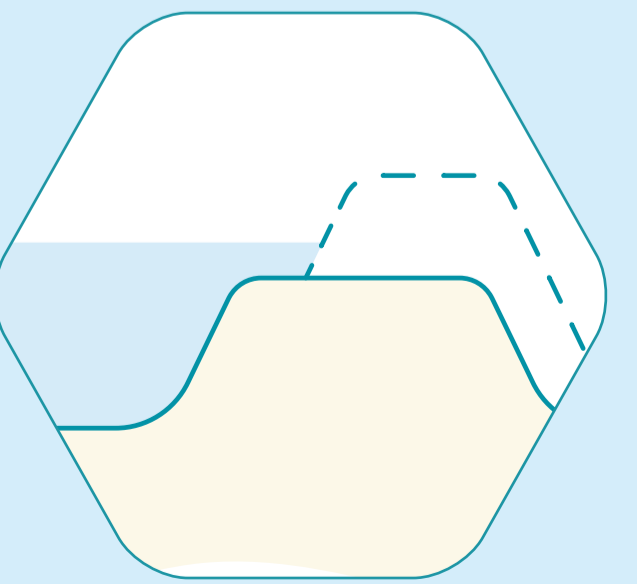
Area	No	Title	Description	Strategic Fit	Potential Value for Money	Supplier Capacity and Capability	Potential Affordability	Potential Achievability	Proposed Shortlist
All	1	Walkaway	A mandatory standard baseline or reference scenario for consideration. It 'means doing nothing, i.e. cease any and all current activities and walk away'						Mandatory 
	2	Business as usual	A mandatory standard baseline or reference scenario for consideration. It is taken to mean 'sustaining the current arrangements'						Mandatory 
Rivers West	3	Direct Defences - Flood Walls/Embankments	Localised defences within the town centre where they can provide direct protection from river flooding.						
	4	River Diversion	A reprofiling of the gradient of the Afon Rhyd-hir so that it diverts flows to the coast at a new location west of the town						
	5	Overpumping on the Afon Rhyd-hir and Afon Penrhos	High volume pumping stations to be constructed in Pwllheli, designed to pump high river flows to the sea when high tides would otherwise cause a backing up effect.						
	6	Upstream Storage	Introducing changes in the upstream land to create greater capacity for flood water to be stored there.						
Coastal West	7	Realign Defences - Coastal	New coastal defences moved marginally inland but remaining consistent with the current alignment along the western coastal frontage, allowing the coastline space to regress.						
	8	Realign Defences - Inland	New coastal defences to the west of the town, perpendicular to the coastal frontage allowing the coastline to regress.						
	9	Beach/Sand Replenishment	Introducing significant volumes of sediment or sand along the western frontage to increase the extent to which the dunes and shore can act as a barrier to storm events .						
	10	Hard Engineering Defences	Hard engineered defences such as rock armour or rip-rap to protect the shoreline against scour and wave erosion.						
	11	Groynes & Breakwaters	Hard barriers (typically rock or timber) designed to help trap sediment and preserve the beach, improving protection from flooding and erosion.						
Harbour/Central	12	Raised Harbour Walls	Increase defence heights around the harbour where needed to manage the risk of flooding from future storm events.						
	13	New Harbour Gate	A regulated barrier at the harbour entrance to create capacity within the harbour to manage river flooding and equally to manage tidal flood risks from storm surges.						
Coastal East	14	Groynes & Breakwaters	Hard barriers (typically rock or timber) designed to help trap sediment and preserve the beach, improving protection from flooding and erosion.						
	15	Hard Engineering Defences	Hard engineered defences such as rock armour or rip-rap to protect the shoreline against scour and wave erosion.						
	16	Beach/Sand Replenishment	Introducing significant volumes of sediment or sand along the eastern frontage to increase the extent to which the dunes and shore can act as a barrier to storm events .						
River East	17	Direct Defences - Flood Walls/Embankments	Raised flood defences in Abererch providing a direct line of defence against flooding from the Afon Erch.						
	18	Upstream Storage	Introducing changes in the land upstream, north of Abererch to create capacity for flood water to be stored there.						
	19	Watercourse Conveyance Improvements	Changes existing structures to allow greater flows to pass, reducing the degree to which upstream water levels within the village are elevated during flood flows.						

Shortlist Option Combinations

There are multiple areas of flood risk in the study area that require mitigation from both fluvial and coastal sources.

Therefore, the location specific options have been joined to create a shortlist of compatible options that cover the whole study area.

The proposed combinations may be subject to change pending the final results of the Strategic Outline Case (SOC) assessment

Option	Rivers West	Coastal West	Harbour / Central	Rivers East	Coastal East
A	Business as Usual	 Managed Realignment (Coastal)	 New Harbour Gate	 New Flood Walls / Upgrade Existing Assets	No Active Intervention
B	 River Diversion	 Managed Realignment (Coastal)	 Raised Harbour Walls	 New Flood Walls / Upgrade Existing Assets	No Active Intervention
C	Business as Usual	 Managed Realignment (Inland)	 New Harbour Gate	 New Flood Walls / Upgrade Existing Assets	No Active Intervention
D	 River Diversion	 Managed Realignment (Inland)	 Raised Harbour Walls	 New Flood Walls / Upgrade Existing Assets	No Active Intervention

Keeping in touch

We will be providing regular project updates, as well as the chance to feedback online.

We want to hear from you so we can further understand the impact of flooding in Pwllheli and the wider community and to consider and develop options that best manage flood risk into the future.

The project aims to deliver a sustainable solution that ultimately reduces flood risk to as many people and homes as possible, both now and in the future. We also want to explore wider environmental and social opportunities that can be developed as part of any preferred option going forward.

Even if you have done so previously, please get in touch if you would like to find out more, and to share your views and comment with us.

Timeline

Following on from the drop-in event at Neuadd Dwyfor Art Centre, Pwllheli in July 2022, and the creation of the online consultation hub, NRW has assessed the longlist options, incorporating the feedback received, and has a draft shortlist prepared.

2022

Scope options

NRW has established the case for change. The longlist of options has been developed with stakeholders and the community.

2023

Present short list options

NRW has appraised the longlist to arrive at a shortlist. This is forming the basis for engagement with stakeholders and the community.

2024

Preparing the preferred option

NRW will utilise the feedback to develop the shortlist. The shortlist will be further appraised to arrive at a preferred option.

2025

Submit preferred option for approval

The preferred option will be developed and a funding application will be submitted to Welsh Government identifying how the preferred option will be delivered.

Ways to feedback



Online survey



NRW website



In person via a team member



Paper copy, use freepost

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