

Cyngor Gwynedd

Barmouth North Promenade FAS

Managed Realignment Options

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1. The Project

1.1 Barmouth Frontages

- 1.1.1 Barmouth is located in Gwynedd on the west coast of Wales, north of the Afon Mawddach estuary. North Promenade is the northmost section of the Barmouth developed frontage, extending from residential housing estate at Heol y Llan to the northern extent of the promenade wall. The study area comprises a mixture of hard defences, including a vertical sheet piled sea wall and precast concrete wave recurve wall units.
- 1.1.2 The existing coastal defences run parallel with the promenade adjacent to the Marine Parade and the Cambrian Railway inland. The coastal defences are in a poor condition. Significant wave overtopping and coastal erosion is observed.

1.2 Scheme Overview

- 1.2.1 Cyngor Gwynedd, supported by YGC, propose to carry out coastal flood and erosion risk management works on a 1.2km length of frontage at the North Promenade region in Barmouth, Gwynedd. The 1.2km scheme area comprises of a mix of hard coastal defences (sheet piled wall, concrete revetment, and wave recurve wall, with masonry setback walls). The defences run parallel with the promenade and adjacent to Marine Parade.
- 1.2.2 The preferred option will reduce the long-term flood risk to both people and properties along the Barmouth seafront, bringing the area in line with SMP2 policy of 'hold the line', with the longer-term considerations towards 'managed realignment'. The project will contribute towards managing flood risk, coastal erosion, and structural failure of the primary coastal defences, adapting to the increasing pressures associated with coastal erosion and climate change.
- 1.2.3 An Outline Business Case (OBC) was submitted by Cyngor Gwynedd in 2021 to seek approval and funding from Welsh Government for the design development and consenting of the project (Stage 1). YGC appointed Alun Griffiths (Contractors) Ltd, with Arup (the 'AGC Team') to progress Stage 1 of the project, which includes developing the outline design, undertake an Environmental Impact Assessment (EIA), Consenting, Detailed Design and Full Business Case (FBC).
- 1.2.4 The preferred option outlined in the OBC is being refined and developed through Stage 1, with a summary of the current design outlined below. These elements are collectively referred to in this report as 'the Scheme':
- Primary wall remediation over a length of approximately 1.2km;
 - Secondary flood defence wall to be re-built structurally and increased in height over a length of approximately 1.1km;
 - Existing sheet piles at the toe of the sea wall to be refurbished over approximately 515m length;
 - Additional rock armour to be provided to protect the primary sea wall and revetment;
 - Refurbishment of culverted outfalls and reinstatement of non-return valves;

- Placemaking and landscape improvements; and
- Flood gates to be installed in the line of the secondary flood defence wall where access is required.

1.3 Scheme Objectives

- 1.3.1 Cyngor Gwynedd seek a solution to reduce coastal flood and erosion risk to Barmouth North Promenade, whilst improving the amenity and environmental value of this section of coastline. Placemaking opportunities such as beach access, dwell spaces and facilities, and improved connectivity and wayfinding have the potential to leverage the less-used asset, broadening the appeal of Barmouth and reducing pressure on the popular South Promenade area.
- 1.3.2 The following Investment Objectives have been identified in the OBC:
- To reduce the threat of coastal flood and erosion risk to people and property with due consideration of SMP2 policy to ensure the long-term resilience and vitality of the community;
 - To support, and where possible enhance, recreation and amenity value of the local area;
 - To maintain, and where possible enhance, natural and historic environments;
 - To ensure marine amenity activities can continue to grow; and
 - Ensure an affordable and deliverable whole life option through a partnership approach and contributions.

1.4 Purpose of this Report

- 1.4.1 The purpose of this report is to show how the proposed works at Barmouth North Promenade are aligned with the Shoreline Management Plan 2 (SMP2) policy, including the proposed Major Change, and possible options for Managed Realignment in epoch 3.
- 1.4.2 The note has been updated following feedback received during the public consultation that closed on 21st November 2025 on the proposed Major Change. Feedback included seeking expanded commentary on the consideration of groundwater flooding, the Welsh National Marine Plan, coastal squeeze and monitoring.

2. Background

2.1 Proposed Development

- 2.1.1 The Proposed Development at Barmouth North Promenade comprises new and improved sea defences, placemaking and surface water drainage improvements. The Proposed Development will provide a standard of protection (SoP) of 1 in 50-year annual chance (2% annual exceedance probability) in 2075 to manage risk to properties with tolerable residual overtopping of the coastal defence.
- 2.1.2 A full description is provided in ES Volume 2.
- 2.1.3 The FBC stage is funded by Welsh Government, with the construction phase co-funded by Welsh Government (85%) and Gwynedd Council (15%). Funding for the FBC has been granted, the construction phase is subject to approval of the FBC.

2.2 SMP

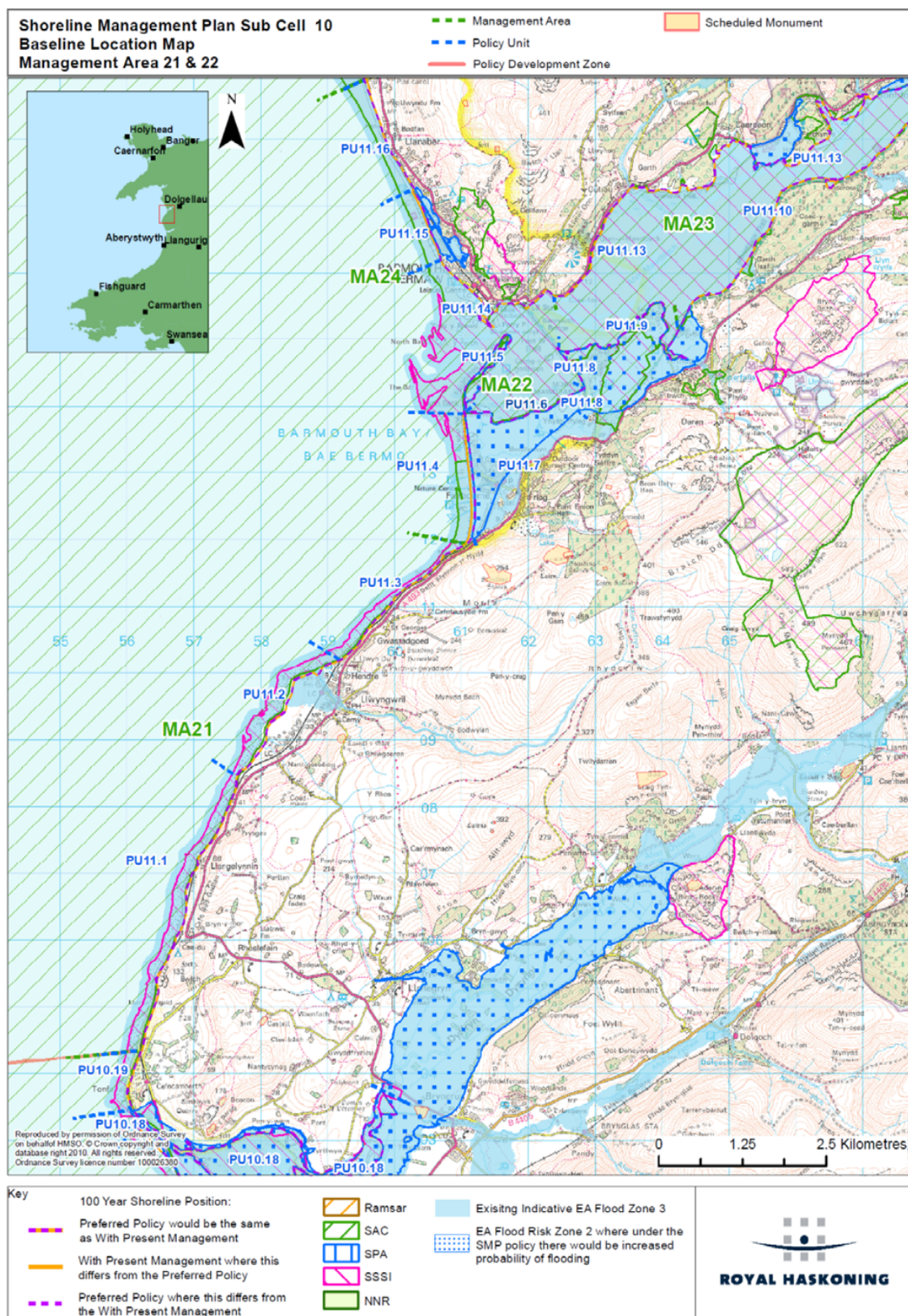
- 2.2.1 A full summary of the SMP2 and its relevance to Barmouth North Promenade was prepared as part of the OBC, and is available in Appendix A.
- 2.2.2 Barmouth is covered by the West of Wales Shoreline Management Plan 2 (SMP2) (2011). The North Promenade is located within the SMP2 Management area 24 (MA24) and Policy Unit 15 (Barmouth North) of SMP Sub Cell 9 and Policy Development Zone (PDZ) 11.
- 2.2.3 The current policy (epoch 1) for the urban frontage of Barmouth North Promenade is to continue to 'hold the line' (HTL). The SMP2 identifies significant pressures on the shoreline defences to the north of Barmouth from climate change and sea-level rise, and suggests the present alignment is likely to become increasingly difficult to sustain. As such, for the medium and long term (epochs 2 and 3 respectively) the SMP2 recommends a change in approach to 'managed realignment' (MR). This is highlighted in Figure 2-1.

Figure 2-1 Summary of specific policies for Barmouth North and adjacent areas

MA 24 BARMOUTH: From Porth Aberamffra to Llanaber Point

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
11.14	Barmouth South	HTL	HTL	HTL	
11.15	Barmouth North	HTL	MR	MR	This may include relocation of properties
11.16	Llanaber	HTL	HTL	HTL	This needs to be considered in term of management to the above policy unit.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

Figure 2-2 Map of specific SMP2 policies for Barmouth North and adjacent areas



2.2.4 The preferred policy to implement the plan is

- From present day to maintain existing defences.
- In the medium term to develop a strategy to look at opportunities for MR at North Barmouth.
- Long term, to maintain defences.

2.2.5 Further relevant text from the SMP2 is given below.

*To the south the SMP2 policy for the area of southern Barmouth, Barmouth harbour and the access road to Barmouth is to Hold the Line. To the north the general policy at Llanaber Point would also be to Hold the Line. **However, to the north end of Barmouth the SMP1 policy of Hold the Line is going to become increasingly difficult to sustain. Consideration should be given to widening the overall defence system in this area.** This may require nearshore or shore connected structures to reduce wave energy but is also likely to require some future realignment of the defences, quite probably with the loss of property. This would require a more integrated approach to management, considering how the northern seafront could be developed to better advantage both in term of use and shoreline management. The SMP2 policy for the northern end of Barmouth would be to Hold the Line during epoch 1, but to change to one of Managed Realignment over epochs 2 and 3.*

*Whilst the Barmouth frontage through to Llanaber would be defined as three policy units, **the policies need to be progressed as one overall area.** The manner in which Llanaber Point is managed influences the way in which the north Barmouth frontage and the manner in which the apex between north Barmouth and south Barmouth is approached needs to be integrating management to both north and south. **In all probability works will be needed to the north Barmouth frontage towards the end of Epoch 1.** Planning for a more adaptive approach to management, therefore, needs to be undertaken during Epoch 1.*

2.2.6 The SMP2 provides limited detail in terms of the suggested approach at Barmouth North Promenade, i.e. proposals should 'consider widening the overall defence system' and may 'require a nearshore or shore connected structures to reduce wave energy but is also likely to require some future realignment of the defence'. It also notes proposals should consider how the northern extents of frontage can be better developed in recognition of both usage and shoreline management. There is clear policy intent to Hold the Line unless impractical. The SMP2 acknowledges that of Managed Realignment would incur the loss of properties at North Promenade to allow width for a sustainable flood and coast risk management.

2.2.7 The SMP2 outlines that whilst the frontage at Barmouth is split over three areas, the policies should be considered and 'progressed as one overall area' – due to the coastal process influences between the areas. The 'manner in which the apex between north Barmouth and south Barmouth is approached needs to be integrating management to both north and south'. To the south the SMP2 policy for the area of southern Barmouth, Barmouth harbour and the access road to Barmouth is to continue to 'Hold the Line', as is the *Llanaber Point* frontage to the north.

- 2.2.8 Similarly, the defined epochs within Figure 2-1 are considered to be less prescribed than indicated, with policy changes seen as a continuous process. “Short term” spans to 2025, “medium term” to 2055 and “long term” to 2105 however SMP2 guidance states

“in terms of policy change over time, the epochs are necessarily indicative’ and ‘the timing of any change in shoreline management policy, in most cases, cannot be defined precisely.”

2.3 Flood Risk

- 2.3.1 The flood cell associated with North Promenade extends to the north and south of the ‘Barmouth North’ SMP policy unit as shown by the NRW Flood Zone 3 extent and therefore this hydraulic connectivity needs to be considered.
- 2.3.2 Unless stated otherwise (see 2.3.4), references to flooding or impact on flooding throughout this report refer to coastal and fluvial / pluvial flood risk.
- 2.3.3 Hydraulic modelling, informed by physical wave overtopping assessments, demonstrates the scale of the interaction and the extent of flood risk and potential property losses in the absence of investment (see Flood Consequence Assessment BMTH-ARP-XGN-ZZ-RP-W-000003 and Figure 3-1). Overtopping from Barmouth North places critical infrastructure (including the Cambria Railway) and a large proportion of the Barmouth community at risk in the absence of the Proposed Development.

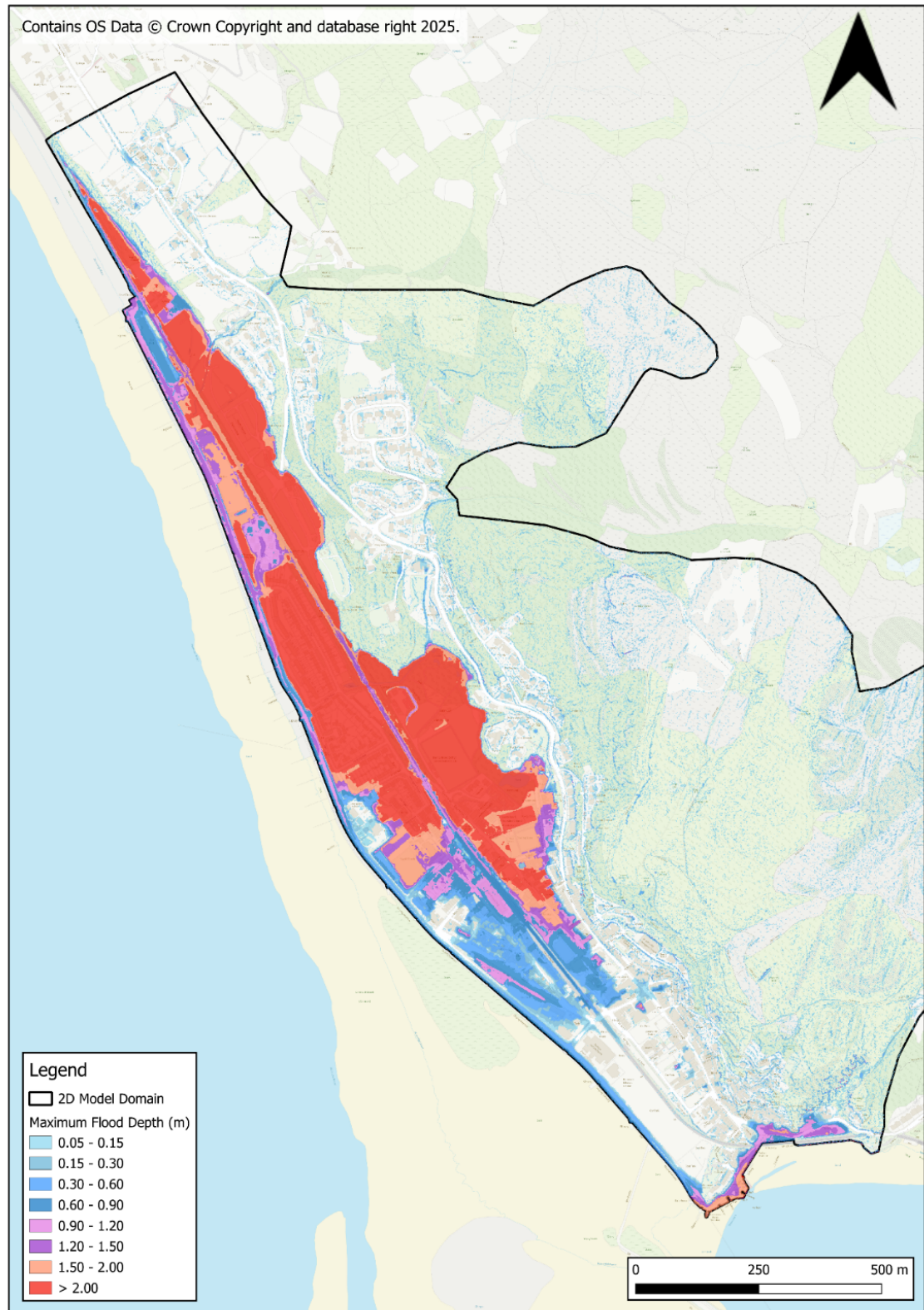
Groundwater flooding

- 2.3.4 Barmouth North may also face an increasing risk of groundwater flooding. The mechanism in this case is saline / coastal ingress underneath the existing promenade structure, the risk of which increases over time in line with sea level rise. This is also a particular risk in Barmouth, noting that the housing landward of the prom is at a lower level than the promenade itself.
- 2.3.5 However, records indicate¹ that no groundwater flooding of properties has occurred in the catchment.
- 2.3.6 As part of the Proposed Development, sheet piling will be installed both underneath the primary wall and the new secondary wall to a depth yet to be determined (i.e. subject to detailed design), in line with Eurocode 7.
- 2.3.7 Sheet piling underneath the existing primary wall is primarily in place to prevent washout of fines from beneath the promenade to the sea, risking structural undermining of the FCERM assets. This will replace and in some areas extend existing sheet piles.
- 2.3.8 New sheet piling will be required underneath the new proposed secondary wall. This is to prevent seepage of floodwater underneath the secondary wall following a flood event, which would undermine the performance of the new FCERM assets as well as potentially their structural stability.

¹ <https://www.gwynedd.llyw.cymru/en/Residents/Documents-Residents/Have-your-say/Flood-Strategy/Appendices-CG-Local-Flood-Risk-Management-Strategy-DRAFT.pdf>

- 2.3.9 The presence of new sheet piles will lengthen the flow paths underneath the promenade, reducing both the risk of coastal ingress resulting in groundwater flooding and of washout of material from underneath it, reducing the risk of .

Figure 2-3 Extent of flood cell for Barmouth in the absence of the Proposed Development (Baseline 1 in 200 annual chance event in 2125)



2.4 Environment

2.4.1 The nearshore Pen Llyn a'r Sarnau SAC is approximately 171m south-west from the site, and runs adjacent to the length of the promenade (see Figure 2-1).

2.4.2 The SMP2 HRA assessment of alternative policy options to Lleyen Peninsula and the Sarnau SAC notes for the Barmouth South, Barmouth North and Llanaber policy units *no constraint to the SAC features would occur*. Further the HRA assessment of Lleyen Peninsula and the Sarnau SAC - Compensatory Habitat in Units within the SAC Frontage concluded *N/A* area in the second and third epochs created by the Managed Realignment policy, noting

Intertidal area fronting the unit is not within the designated site; therefore at this stage the potential habitat created during MR is not examined. However, could potentially review opportunity to improve intertidal habitat within the foreshore, and realignment of defences could provide additional intertidal habitat.

2.4.3 Managed Realignment is most likely to be beneficial in areas of low agricultural land or where the topography and neighbouring land-uses minimise the need for additional defences to mitigate adjacent impacts or extensive decommissioning. In most instances, Managed Realignment is used to restore or create tidal habitats (e.g. salt marshes) compensating for habitats lost to development or coastal squeeze. Such creation can provide significant economic benefits, including ecosystem services such as recreation, enhanced carbon sequestration and improved biodiversity. However the OBC noted a *limited opportunity to increase marine habitats* in this frontage with *extents to which habitat creation can be achieved appear to be constrained by the limited land gained seaward as a result of the realignment*. The OBC's initial environmental appraisal for the preferred option concluded *no significant environmental implications are expected as a result of the scheme. Direct habitat loss from the SAC will not occur*.

2.5 Enhancements and Welsh National Marine Plan

2.5.1 A separate note has been prepared on how the Proposed Development aligns with the Welsh National Marine Plan (WNMP) (document ref BMTH-ARP-MAN-ZZ-RP-ZQ-000001), including policies related to enhancements of marine ecosystems. This document identifies the policies from the Welsh National Marine Plan relevant to the current application for the Proposed Development and how they have been considered in a proportionate way to the Proposed Development's scale, potential impacts and risk.

2.5.2 Key policies related to enhancements, and how these have been considered as part of the Proposed Development, are summarised below.

Welsh National Marine Plan Policy	Does the project have the potential to impact the policy?	Consideration- How does the Proposed Project Comply with the Policy?
ENV_01: Resilient marine ecosystems Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference: a. avoid adverse impacts; and/or b. minimise impacts where they cannot be avoided; and/or c. mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.	Yes	To ensure access and safe use of the beach, approximately 500m of groynes supporting blue mussel growth (<i>Mytilus edulis</i>- a priority Habitat under Section 7 of the Environment (Wales) Act 2016) will be removed. To mitigate for the loss of groynes which cannot be feasibly incorporated into the design, bespoke intertidal habitat creation measures have been proposed. A series of new timber posts will be installed in two parallel lines (each approximately 25m long). Existing timber groynes currently supporting blue mussels will be translocated and securely attached to each of the new timber posts, to provide a “like-for-like” replacement of the groyne habitat. The new groynes will be surrounded by a perimeter of rock armour (3 - 6ton rocks) to provide further substrate for blue mussel growth.
ENV_02: Marine Protected Areas Proposals should demonstrate how they: • avoid adverse impacts on individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; • have regard to the measures to manage MPAs; and • avoid adverse impacts on designated sites that are not part of the MPA network.	Yes	A number of assessments have been undertaken to consider the impacts of the Proposed Development on protected habitats and species within the surrounding area. The nearest designated site (Pen Llŷn a'r Sarnau SAC) is located 31m west of the Site, below MLWS. Embedded measures will ensure piling activity and any other percussive or noise generating construction activities are undertaken in dry conditions either side of, which will negate any impacts to mobile species associated with the SAC which may otherwise be present in proximity to the active works areas during high tide.

2.6 Major Change

- 2.6.1 In September 2024 during engagement with the West Wales Coastal Group, it was agreed that the OBC preferred option (as approved by Welsh Government) required a change to the SMP2 policy from Managed Realignment in epoch 2 to Hold the Line.
- 2.6.2 As coastal protection authority, this requires Cyngor Gwynedd to progress through the newly developed Major Change process. The issue was discussed at the July 2025 West Wales Coastal Group (see Appendix D). YGC continue to consult the public and key stakeholders on this issue specifically, and a Change subgroup has been set up.

- 2.6.3 The change is proposed due to further detailed analysis of options to manage flood and coastal erosion risk as part of the OBC and subsequent FBC, whilst improving the amenity and environmental value of the frontage (see Section 1.3). The OBC identified a long list of options which were refined into four shortlisted options. Each shortlisted option was analysed against engineering performance, sustainability and well-being performance, their economic performance and their financial performance.
- 2.6.4 Managed re-alignment was considered as Option 4. The analysis concluded implementing a set-back defence via Managed Realignment across the whole frontage in 2025 would be premature and was not favoured at present:
- Significant residual value of current defences, with targeted repair works planned as part of the Proposed Development.
 - Significant costs with decommissioning current defences.
 - Significant loss of residential properties.
 - Risk (or constraint) of critical infrastructure including the Cambrian Railway in close proximity.
 - Loss of recreational amenity.
 - Limited environmental gain due to the nature of the landscape and adjacent Hold the Line policy units.
 - Environmental risk due to made ground within the set-back area.
- 2.6.5 The OBC preferred approach identified a pathway with Managed Re-alignment implemented in the long-term epoch. The preferred approach is an adaptive pathway that involves investing now in actions to manage today's risks, monitoring the change in risk over time (such as the impact of climate change and response of coastal processes across the three frontages) and a plan to manage these changes. The OBC notes that managing coastal risk at the site in the medium to long term will be challenging and proposes that managed realignment at the northern half of the policy unit is the most viable option at this point. This option is included as part of the preferred approach.
- 2.6.6 The OBC preferred approach will:
- Safeguard residential properties.
 - Provide time for funding mechanisms to be developed to support managed realignment.
 - Provide flexibility for the uncertainty of climate change.
 - Allow the community to gain tourism, social & well-being amenity benefits from the promenade.

3. Summary of work to date

- 3.1.1 The OBC evidence base included coastal processes studies and modelling, wave and overtopping inundation modelling, topographic surveys, geotechnical desk study and environmental appraisals. All informed the option appraisal process.
- 3.1.2 The OBC preferred approach involves investing now in actions to manage today's risks, monitoring the change in risk over time and developing a plan to manage these changes. The preferred approach has a strong justification and current defences with a low residual life. The preferred approach reduces risk to life to people and reduces flood risk to 757 properties. Wider project benefits include safe-guarding and enhancing the health, amenity and recreational value of the area, and protecting a stretch of the Cambrian Coastal Railway.
- 3.1.3 As part of the approved OBC, a technical note (Appendix B) was prepared to set out the options for Managed Realignment and their potential implications. Table 3-1 includes a summary of the impacts of managed realignment.
- 3.1.4 The note considered two feasible options for managed realignment at Barmouth North which set back defences to the Cambrian Railway. One of these options would result in the loss of residential properties.
- 3.1.5 Both options recommend monitoring as part of the solution.

Table 3-1 Summary of MR at Barmouth North Promenade (ref: Appendix B)

Summary of impacts	
Engineering performance	Opportunity to provide a long-term sustainable FCERM scheme at Barmouth North Promenade.
Economic performance	Of significant cost and associated risks, particularly in terms of the removal of the existing defences and relocation of existing residential properties. There is a perceived limited gain, for significant financial expenditure.
Environmental Performance	Potential opportunities to promote habitat creation, although this is considered to be limited.
Social & Wellbeing	Potential negative implications on local residents and businesses, particularly without adequate consultation and support structures to facilitate Managed Realignment.
Political and Financial Performance	Significant risks associated with funding structures and mechanisms.

- 3.1.6 During FBC, proposals for the improvement of existing defences to 2075 have been developed, and are described in the other ES Volumes. To support this, a range of activities have been carried out that allow better understanding of managed realignment:
- Environmental and ecology surveys and assessment;
 - Ground investigation;
 - Hydraulic modelling;
 - Civil and structural design; and
 - Public consultation.
- 3.1.7 The Proposed Development's Habitats Regulation Assessment screened out Coastal Squeeze.

3.2 Engagement and Consultation

- 3.2.1 Multiple stages of engagement informed and influenced the SMP2 throughout 2009 and 2010 before formal consultation (see <https://www.grwparfordirolgorllewincymru.cymru>) and then Gwynedd Council adoption.
- 3.2.2 The OBC was developed working closely with stakeholders to understand their concerns and decide how best to go forward. A well-attended initial public information exhibition was held in collaboration with NRW on 25/03/19 with general support for the then emerging preferred approach. Feedback emphasised the value of the North Promenade as an asset for amenity, recreation and health benefits. YGC continued engagement with key stakeholders and elected members. Engagement has continued to inform the Proposed Development, as outlined in the ES.
- 3.2.3 The following non-technical summary has been prepared to support consultation in September 2025:

Shoreline Policy

Barmouth is covered by the West of Wales Shoreline Management Plan 2 (SMP2) (2011). The current policy for Barmouth North Promenade is to 'hold the line' in the short term. The SMP2 identifies significant pressures from sea-level rise, and suggests the present alignment is likely to become increasingly difficult to sustain and a change to 'managed realignment' for the medium and long term. "Short term" spans to 2025, "medium term" to 2055 and "long term" to 2105. However, SMP timescales are necessarily indicative.

SMPs are high-level. Detailed studies found coastal erosion and flood risk interacts with adjacent Llanaber and Barmouth South frontages (both long term 'hold the line'). With modelling and appraisal, the case to invest to improve defences to 2075 has been proven.

The Proposed Development will require a change to the SMP2 policy from Managed Realignment to Hold the Line to at least 2075. A Policy Change Subgroup has been set up by the West Wales Coastal Group to manage this change. YGC are consulting the public and key stakeholders on this issue specifically. Your views are welcome.

In the long term there is a choice of options ranging from hold the line with investment to maintain or improve defences to decommissioning all/some of the existing promenade to enable managed realignment (below right). Monitoring the performance of the defences is planned. The findings will inform the case for further investment and the long term approach.

Major Change engagement

- 3.2.4 Consultation on the major change was carried out from 17 October to 21 November 2025. YGC consulted the public and key stakeholders on this issue specifically with associated publicity and information shared on the project website. This note and the Coastal Squeeze Assessment have been updated to address the Natural Resources Wales response.

4. Summary of Long Term Options

4.1.1 In the description of all options, the Site has been split into two sections (North and South), with the split between sections at a point just to the North of the properties on Tai'r Heli. South of this point, the new flood defences are directly in front of properties, and to the North they are used to prevent outflanking and protect the Cambrian Coastal Railway.

4.2 Constraints

4.2.1 All options assume the OBC preferred option, the Proposed Development, is implemented. This will provide a standard of protection (SoP) of 1 in 50 annual chance in 2075 to manage risk to properties with tolerable residual overtopping of the coastal defence, extending the residual life of the existing defence system.

4.2.2 The design life and maintenance requirements of the Proposed Development elements varies.

- Structural elements including the flood defence walls are designed in accordance with the Design Manual for Roads and Bridges with a 120-year design life. The structures are designed with consideration of exceedance events up to the 1 in 1000 annual chance event in 2125 (i.e. ensuring no breach in the event of overtopping) or limitations communicated and mitigations highlighted within the management plan.
- The rock revetment is formed from inert boulders assembled into a revetment designed to withstand a 1 in 200 annual chance event in 2075. Maintenance requirements will include reforming the revetment should any movement of boulders be experienced during exceedance events.

4.2.3 Proposals consider residual surface water flooding. The scope for assets in the proximity of the promenade (including current outfalls and drainage) is limited to tidal non-return provision and manage the risk of future blockages.

4.2.4 In general, in a populated area with existing hard defences, a walkaway 'do-nothing' scenario is likely present unacceptable hazards. Managed Realignment requires 'decommissioning/relocation' which carry significant risks/costs that need to be managed carefully over the long-term.

4.2.5 The Cambrian coastal railway is assumed required to remain along its current alignment in the absence of legislation enabling stopping up, and to need to remain protected from flooding throughout epochs 2 and 3.

4.2.6 In addition, the topography of Barmouth to the seaward side of the railway is relatively flat (or lower than the promenade level) and forms a semi-continuous flood cell across three frontages. This means that any managed realignment options involving the relocation of properties would likely require a line of defence at the railway, and therefore a large number of properties would be relocated. It would also be challenging to tie this with the Hold the Line policy of South Barmouth.

4.2.7 Although the loss of properties is mentioned in the SMP2, there are limited legal powers and no established legal process to facilitate this. No options have considered widespread direct relocation of properties.

- 4.2.8 All options could include need to increase existing defence provision towards the south of the frontage (e.g. construction of revetment, raising primary wall, raising secondary wall, offshore structure).

4.3 Option 1 – Retain promenade access

Description

- 4.3.1 In this option, the line of defence to the South of the site remains as per the secondary wall built as part of the Proposed Development. Increasing the height of this wall could be considered but would likely be subject to its own business case.
- 4.3.2 To the North of the site, the line of defence would be moved landward to run parallel and adjacent to the Cambrian railway behind the open ground, Promenade Café and skatepark, to then tie in to the secondary wall constructed as part of the Proposed Development. This defence would likely be a new secondary wall, or bund.
- 4.3.3 The secondary wall constructed as part of the Proposed Development in this area would be demolished, as well as the associated demountable defences.
- 4.3.4 Defences on the beach would remain, as would the primary wall, and associated beach access structures.
- 4.3.5 Consideration would be needed as to whether the pedestrian level crossing by the existing Barmouth skatepark would remain, or be closed off.

Impact on flooding

- 4.3.6 Flooding to the promenade, café, Pen-y-Gogledd car park and associated recreational facilities would increase over time in line with climate change. The proposals will deliver a coastal flood risk 1 in 50 annual chance standard of protection with allowance for the impacts of climate change in 2075 which approximately equivalent to a 1 in 10 annual chance event storm in 2125. Residual surface water risk and the risk of tide-locking will also increase.
- 4.3.7 Although access to the promenade would be maintained, it would need to be closed in flood events (as existing, and to continue as per proposed development). This would become increasingly frequent, reducing access to car park, amenity areas and level crossings.
- 4.3.8 Associated with this is the increasing risk of damage to the promenade as existing assets and those as part of the Proposed Development deteriorate, and forces from wave action increase. This increases the risk of collapse, and the need for additional maintenance.
- 4.3.9 The hazard rating of the promenade and other areas not defended by the primary wall would increase, presenting a risk to life. Retaining access to the promenade would increase the likelihood of members of the public being at risk.
- 4.3.10 Once the beach defences and primary wall are overtopped by a storm event, the area available for water to accumulate will be considerably larger than with the Proposed Development. This would reduce water levels in front of the secondary wall and potentially lead to a reduction in overtopping for the same storm event.

Cost

- 4.3.11 The demolition of the secondary wall and construction of new defences to protect the railway and prevent outflanking would require a significant upfront cost, including design, consenting, and construction. Cyngor Gwynedd do not own the area of land that would become undefended, and so additional land costs may also be incurred.
- 4.3.12 Ongoing maintenance costs for the primary defences and retained sections of the primary wall would remain, and costs of maintaining new defences would be required.
- 4.3.13 The increasing number of promenade closures would both increase operational costs and reduce revenues from car parking and other recreational activities. Some savings to operational costs would be made through the need for fewer demountable defences.

Alignment with SMP

- 4.3.14 This option would be in alignment with the SMP2 policy given that it would:
- Widen the overall defence system in the area;
 - Better develop the northern seafront; and
 - Progress the whole frontage as one overall area - tying in with the Llanaber and Barmouth South policy units with a 'Hold the Line' policy.
- 4.3.15 However, it should be noted that the policy in the southern portion of the policy unit would still effectively become 'Hold the Line'.

Environmental impact

- 4.3.16 There is an opportunity to ecologically enhance the newly undefended area, utilising the increased frequency of flooding to that area. There is a possibility that coastal grassland or coastal grazing marsh could be created, although it should be noted that the need to keep the promenade open in this option is likely to limit opportunities, as is the presence of made ground.
- 4.3.17 The impact on coastal processes is likely to be very limited, since the defences on the beach are to remain unchanged.
- 4.3.18 The visual impact of the works is likely to be reduced in comparison with the Proposed Development, given the removal of the secondary wall. The new raised defence will have its own visual impact.
- 4.3.19 The construction impacts of the new works will likely be similar to that of the Proposed Development (an increase in traffic volumes, temporary disruption, noise and vibration) through the demolition of the secondary wall and construction of a new secondary defence. The magnitude is likely to be less, given the reduced extent of the works.

4.4 Option 2 – decommission defence portion

Description

- 4.4.1 This option is similar to option 1, except access to the northern section along the Promenade would be permanently restricted. In this case, defences on the beach, the primary and secondary wall throughout this section could be removed, and replaced with a new secondary defence along a similar alignment to that described in option 1. Other elements of promenade infrastructure (i.e. the highway, surfacing and access structures) would also be removed.
- 4.4.2 The Promenade Café, Pen-y-Goglledd car park and associated amenity infrastructure would no longer be accessible and the two railway level crossings would be closed off. The only feasible option might be to abandon and decommission these assets.
- 4.4.3 Access to the buildings on the landward side of the railway to the North of the promenade would only be from the A496 via the steep, narrow lane.
- 4.4.4 Depending on extent of removal and final design, may well develop into similar profile to area immediately to the North, although likely consisting of different material.

Impact on flooding

- 4.4.5 The entire area would be flooded considerably more regularly and would likely become permanently inundated to a large degree.
- 4.4.6 Uncertainty on flood defences required for railway line given degree of coastal processes change. To be conservative a large structure is assumed needed to be constructed to reduce overtopping risk to the railway to acceptable levels to avoid widespread flooding beyond the frontage across the floodplain.
- 4.4.7 Surface water flood risk would be worsened as the space to store water at times of tide lock would be reduced.

Cost

- 4.4.8 Higher capital costs than option 1 due to degree of demolition/decommissioning and likely larger and more complex defences to the railway.
- 4.4.9 Land purchase would likely be required for all the areas (including café) that would be removed.
- 4.4.10 Maintenance costs to the existing infrastructure would be removed. However, there would be greater uncertainty around the proposed solution, and therefore a higher need for monitoring and remedial works
- 4.4.11 Revenues from car parking and amenity in the area would be removed.

Alignment with SMP

- 4.4.12 This option would be in alignment with the SMP2 policy given that it would:
 - Widen the overall defence system in the area
 - Better develop the northern seafront

- Progress the whole frontage as one overall area - tying in with the Llanaber and Barmouth South policy units with a 'Hold the Line' policy.

4.4.13 However, it should be noted that the policy in the southern portion of the policy unit would still effectively become 'Hold the Line'.

Environmental impact

- 4.4.14 Any solution could be designed to enhance nature creation. How the coastline would develop to the Northern portion of the policy unit is uncertain. Should decommissioning include removal of made ground, the frontage could overtime create a berm of similar form to the shingle ridge to the North of the Proposed Development, or a beach more similar to that seen towards the south of the policy unit. This may provide opportunities for ecological enhancement including sand dunes and coastal grazing marsh. However due to the limited extents, any benefits achievable are considered to be limited.
- 4.4.15 The managed re-alignment of the foreshore would lead to some loss of the existing hinterland habitat, while this would need to be considered and assessed, the existing habitat is generally of low ecological value being largely developed.
- 4.4.16 There could be an impact on coastal processes, and detailed modelling and analysis would be required to predict it.
- 4.4.17 There would be a considerable change in visual impact from the removal of the defences and promenade, providing a much more natural look. However, it would not be in line with the historic nature of the promenade.
- 4.4.18 Community impacts would be considerable as part of an important recreational and amenity asset would be removed, as well as transport links. Consideration would need to be given to the active travel routes including national cycle network, and whether access could be maintained to this portion of coastline for recreation.
- 4.4.19 The construction impact of the works would be considerable given the scale of works required.

4.5 Option 3 –'Hold the Line'

Description

- 4.5.1 In this option, the line of defence remains as per the Proposed Development, essentially holding the line from epoch 2 to epoch 3.
- 4.5.2 Within this option, there are two possibilities depending on whether the standard of protection is increased from the Proposed Development, or no further improvements are made (essentially a 'do minimum' option).
- 4.5.3 It is expected that the decision to increase the standard of protection would be assessed based on a separate business case. The benefits of the Full Business Case for the proposals do not allow or assess the residual value of the assets beyond 2075.
- 4.5.4 If the standard of protection is to be improved, this could be achieved by:
- Raising the primary wall;

- Increasing the height and / or extents of the rock revetment (for instance, it could be extended further South);
- Increasing the height of the secondary wall;
- Constructing a new offshore structure; or
- A combination of the above measures.

Impact on flooding

- 4.5.5 If defences are not improved, properties and infrastructure in Barmouth will be flooded increasingly often, and to greater extents, with defence standard of protection reducing to 1 in 10 annual chance event storm by 2125. Residual surface water risk and the risk of tide-locking will also increase. This poses a greater risk to life, as well as damages.
- 4.5.6 Any improvements to defences will reduce flood risk proportionally.
- 4.5.7 Flooding to the promenade, café, Pen-y-Gogledd car park and associated recreational facilities would increase over time in line with climate change.
- 4.5.8 Although access to the promenade would be maintained, it would need to be closed in flood events (as existing, and to continue as per proposed development). This would become increasingly frequent, reducing access to car park, amenity areas and level crossings.
- 4.5.9 Associated with this is the increasing risk of damage to the promenade as existing assets and those as part of the Proposed Development deteriorate, and forces from wave action increase. This increases the risk of collapse, and the need for additional maintenance.

Cost

- 4.5.10 The capital costs associated with this are dependent on potential improvements to the standard of protection, and so range from zero to high costs.
- 4.5.11 Ongoing maintenance costs for the primary defences and sections of the primary wall would remain.
- 4.5.12 The increasing number of promenade closures would both increase operational costs and reduce revenues from car parking and other recreational activities. Some savings to operational costs would be made through the need for fewer demountable defences.

Alignment with SMP

- 4.5.13 In this option, there would be no change in approach between epochs 2 and 3. A 'hold the line' approach in epoch 3 is not in line with the current SMP2.
- 4.5.14 An additional Major Change proposal could be considered to change the epoch 3 policy from MR to HTL.
- 4.5.15 This approach would bring this policy unit in line with the adjacent ones to the north and south, noting SMP2 says that "policies need to be progressed as one area".

Environmental impact

- 4.5.16 The construction impact of this policy would be dependent on whether the standard of protection is improved. If it is not, no construction work would be required. If the standard of protection is increased, impacts would likely be similar to those in the Proposed Development.
- 4.5.17 Long term environmental impacts would be limited, as the overall approach would not change compared with the Proposed Development.
- 4.5.18 A key impact of this option would be on the local community. If the standard of protection of the defences is not increased, properties will flood increasingly often, increasing the risk to life as well as having significant mental health impacts on the community. If the standard of protection is increased, this will mean increasingly large defences in the area, likely impacting the character of the area and its connection with the sea.

5. Monitoring and triggers

5.1 Introduction²

- 5.1.1 Epochs provide a useful, broad-scale understanding of timescales. However, they remain open to misunderstanding as to when transitioning (or changes) may be required. In this case, it is useful to identify triggers as to what drives the need for policy transition.
- 5.1.2 Management triggers are points at which a change in policy transition (in this case, towards managed realignment), may be required beyond the timescales defined in the SMP. Trigger types are “*a parameter or combination of parameters that can reach a point where existing policies and responses would need to transition or change*”, where trigger points are the “*The limit relating to the trigger that, once reached, would result in policy transition or change.*”
- 5.1.3 Trigger types may be physical (measurable values) or enablers / inhibitors, such as the capacity of a community for change. Further examples are given in the supplementary guidance.
- 5.1.4 A five-step process is recommended, which the rest of this section explores:
- Determine which key trigger type(s) is relevant to the transition in policy.
 - Establish for each trigger type the level or threshold that will require transition.
 - Estimate the timing when that trigger level is expected to be reached.
 - Identify the activities needed to prepare for transition.
 - Estimate the lead in time to deliver those activities.

5.2 Define critical triggers

- 5.2.1 The below tables give example trigger types and values that could be used in relation to a need to change policy at Barmouth North.
- 5.2.2 The overall trigger that may require MR to be implemented at Barmouth North is if the FCERM asset (i.e. the promenade and Proposed Development) fall below the required standard – a combination of condition and performance.
- 5.2.3 The indicators of this performance and condition are the triggers in Table 1.

Table 1 Potential physical triggers to consider

Trigger type	Relevance to this SMP change	Example values to use
Flood risk probability and frequency	More overtopping of the HTL defences than expected due to increasing frequency and magnitude of storm events.	Mean average water levels, extents of flooding of the promenade.
Defence or structure deterioration	Condition of primary wall or other parts of the promenade deteriorates to the extent that it is not providing a flood risk function and maintenance is not practical	Condition grade

² <https://naturalresources.wales/media/694585/shoreline-management-plans-supplementary-guidance-for-their-ongoing-maintenance-and-delivery-in-wales.pdf>

Climate change	Sea level rise predictions change, leading to increased overtopping of the HTL defences.	Accepted climate change values
Beach level	The defences have been designed to take into account a reasonable worst case beach level. Levels dropping below this could lead to increased overtopping or worsening condition.	Beach level surveys at Barmouth North.

5.2.4 Enabler / inhibitor triggers are those reliant on external conditions or change in circumstances of the area protected by the defence, as in Table 2.

Table 2 Potential enabler and inhibitor triggers

Trigger type	Relevance to this SMP change
Insufficient funding or lack of affordability, meaning planned interventions are not deliverable.	If funding is not available to implement the preferred option
Relocation of infrastructure, property or people, meaning intervention requirements change.	A change in the number or relocation of properties behind the promenade, or a relocation or abandonment of infrastructure (e.g. the railway line)
Changes in land use or development, including new development or decommissioning of site	Additional development in Barmouth, in particular North of the existing properties.
Changes to legislation or national policy	
Adjacent frontage	The current shingle berm geometry has been tested within physical wave modelling and shown not to risk compromising the performance of the proposed scheme. There is a risk of flooding of Barmouth should the frontage to the North (Llanaber) not be maintained and sustained.

5.3 Assess when these may be reached

- 5.3.1 The proposed 'hold the line' scheme has been designed in line with the latest sea level guidance from UK Climate Projections 2018 (UKCP18) and other guidance. New or updated guidance may give new predictions as to when these design levels are reached, requiring an updated analysis as to when the standard of protection is still suitable.
- 5.3.2 The deterioration of assets can be predicted in relation to their current condition and environment using standardised deterioration curves. These could be used in relation to the 'hold the line' flood defence assets to assess when the trigger may be reached. The assets constructed as part of the proposed development have a range of design lives, with 100 years for structural elements such as the secondary flood wall.
- 5.3.3 Enablers / inhibitors are generally 'absolute' or would require planning permission. This means that assessing when they may need to be reached in advance is difficult, however if they do occur, the Council is likely to have sight of changes in policy or planning permission.

5.4 Define monitoring and analysis

5.4.1 The following monitoring and analysis is likely to be required in relation to the triggers identified in Table 1:

- Regular monitoring of beach levels, in particular after large storm events
- Condition assessments of the FCERM assets
- Review of climate change guidance and sea level rise projections when published.
- Review of levels at Barmouth tide level gauge, and national extreme water level information
- Visual and / or topographic inspection of the shingle berm to the immediate north of the site at Llanaber

5.5 Enabling actions

5.5.1 If the monitoring and analysis outlined above, or any other, suggest that a trigger is to be met within the next six years (in line with current FCERM funding rounds), it is suggested that a business case is pursued to provide further review and options appraisal of Managed Realignment.

6. Conclusion

- 6.1.1 The frontage of North Promenade has a high degree of connectivity with the adjacent frontages in terms of coastal processes, flood risk and constraints (such as the railway). This makes policy departures for the frontage from the adjacent Hold the Line policies to the north and south challenging.
- 6.1.2 The Proposed Development maintains HTL to 2075. This complies with the policy plan given the flexibility of the timescales indicated; the additional detail in the SMP2 on the need to improve defences towards the end of epoch 1; and the approved OBC.
- 6.1.3 The construction of the Proposed Development is in line with the preferred policy to implement the SMP2, by allowing a strategy to look at opportunities for MR to be developed in the long term.
- 6.1.4 The intertidal area fronting the unit is not within the designated Llyn Peninsula and the Sarnau SAC. The potential for compensatory habitat from managed realignment was not examined by the SMP2 HRA. An assessment of alternative policy options concluded no constraint to the SAC features would occur.
- 6.1.5 The note has also suggested example triggers that may drive the need for policy transition, and the monitoring that would be carried out for these triggers.
- 6.1.6 Monitoring across the three frontages is required as part of the proposed adaptive pathway approach at the OBC to inform decisions around when further works may be needed. This would include monitoring of:
- The condition and performance of defences
 - Sea level rise
 - Storm events
 - Beach levels
- 6.1.7 Beyond 2075 and into epoch 3 there is a choice of options ranging from a 'do minimum' HTL with no increase in standard of protection to properties to a managed realignment option with significant decommissioning of the existing promenade.
- 6.1.8 These options could either directly comply with a managed realignment policy in epoch 3, or require a further major change to the SMP2 policy plan.
- 6.1.9 The construction of the Proposed Development does not prevent development of a managed realignment option. Therefore, the Proposed Development is compliant with the SMP2 following the proposed Major Change, although further work is required to decide on a preferred way forward.

Abbreviations List

AGC	Alun Griffiths Contractors
D&B	Design and Build
ECI	Early Contractor Involvement
EIA	Environmental Impact Assessment
ES	Environmental Statement
FAS	Flood Alleviation Scheme
OBC	Outline Business Case
YGC	Ymgynghoriaeth Gwynedd Consultancy

Glossary

Coastal squeeze	The progressive reduction and loss of coastal habitat area and natural features which can arise if the natural landward migration of a habitat under sea level rise is prevented by man-made defences and structures.
Hold the line	An SMP policy option that involves maintaining or changing the standard of protection provided by the existing defence line by carrying out work in front of existing defences (such as beach replenishment, rebuilding the toe of a structure, building offshore breakwaters, etc).
Managed Realignment	An SMP policy option that allows the shoreline to move backwards or forwards, with management to control or limit movement (such as reducing erosion or building new defences on the landward or seaward side of the original defences).
PDZ	Policy Development Zone (introduced during the SMP review 2009-2010)
Residual life	The time to when a defence is no longer able to achieve minimum acceptable performance criteria in terms of serviceability or structural strength.
Residual risk	The risk which remains after risk management and mitigation. It may include, for example, risk due to very severe storms (above design standard) or exceedance events.
Shoreline Management Plan	It provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner.

Appendices

Appendix A SMP Policy Context Note

File Note

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Subject SMP2 Context and Policy Direction for Barmouth North Promenade

1 Introduction

Ove Arup and Partners (Arup) have been appointed in September 2018 by YGC, part of Cyngor Gwynedd Council (CGC) to deliver an Outline Business Case (OBC) for coastal risk management for the Barmouth North Promenade frontage. Barmouth is located in Gwynedd on the west coast of Wales, north of the Afon Mawddach estuary. The North Promenade is the northmost section of the Barmouth developed frontage, extending from residential housing estate at Heol y Llan to the northern extent of the promenade wall.

This note sets out the SMP2 context and policy direction for Barmouth North Promenade, with reference to the development of the OBC and the associated options for Flood and Coastal Erosion Risk Management (FCERM). It is envisioned this document will support or form part of the main OBC document within the ‘Strategic Case’.

2 SMP2

The West of Wales Shoreline Management Plan 2 (SMP2) (2011) sets out the policy for coastal risk management across the region. Barmouth North Promenade is located within the SMP2 Management area 24 (MA24) and Policy Unit 15 (Barmouth North) of SMP Sub Cell 9 and Policy Development Zone (PDZ) 11.

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Figure 1. Location of policy extents for Barmouth North Promade (SMP2, 2012)

The current policy (epoch 1) for the urban frontage of Barmouth North Promenade is to continue to ‘hold the line’. The SMP2 identifies significant pressures on the shoreline defences to the north of Barmouth. With the additional implications of climate change and sea-level rise, it suggests the present alignment is likely to become increasingly difficult to sustain. As such, for the medium and long term (epochs 2 and 3 respectively) the SMP2 recommends a change in approach to ‘managed realignment’¹. To the south the SMP2 policy for the area of southern Barmouth, Barmouth harbour and the access road to Barmouth is to ‘Hold the Line’ across the defined epochs.

Table 1. Summary of specific policies (SMP2 PDZ11, 2012)

MA 24 BARMOUTH: From Porth Aberamfrra to Llanaber Point

Policy Unit		Policy Plan			
		2025	2055	2105	Comment
11.14	Barmouth South	HTL	HTL	HTL	
11.15	Barmouth North	HTL	MR	MR	This may include relocation of properties
11.16	Llanaber	HTL	HTL	HTL	This needs to be considered in term of management to the above policy unit.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

The rationale and context from the SMP2 is repeated below.

To the south the SMP2 policy for the area of southern Barmouth, Barmouth harbour and the access road to Barmouth is to Hold the Line. To the north the general policy at Llanaber Point would also

¹ SMP2 Definition of Managed Realignment (MR): by allowing the shoreline to move backwards or forwards, with management to control or limit movement (such as reducing erosion or building new defences on the landward side of the original defences). The intention of a policy of MR is to either create or allow the conditions for the coast to realign and/ or retreat. (West of Wales SMP2, 2012)

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be to Hold the Line. However, to the north end of Barmouth the SMP1 policy of Hold the Line is going to become increasingly difficult to sustain.

Consideration should be given to widening the overall defence system in this area. This may require nearshore or shore connected structures to reduce wave energy but is also likely to require some future realignment of the defences, quite probably with the loss of property. This would require a more integrated approach to management, considering how the northern seafront could be developed to better advantage both in term of use and shoreline management. The SMP2 policy for the northern end of Barmouth would be to Hold the Line during epoch 1, but to change to one of Managed Realignment over epochs 2 and 3.

Whilst the Barmouth frontage through to Llanaber would be defined as three policy units, the policies need to be progressed as one overall area. The manner in which Llanaber Point is managed influences the way in which the north Barmouth frontage and the manner in which the apex between north Barmouth and south Barmouth is approached needs to be integrating management to both north and south. In all probability works will be needed to the north Barmouth frontage towards the end of Epoch 1. Planning for a more adaptive approach to management, therefore, needs to be undertaken during Epoch 1.

2.1 Policy implications and proposed approach

Hold the line generally comprises maintaining or improving defences and beach management activities to provide protection from coastal flood and erosion to important assets or features along the coastline. Activities may include local adjustments to the alignment of defences, replacement of existing structures or new defences constructed.

Managed Realignment can take a wide variety of forms, within the context of a defended frontage this can include:

- Setting back defences to a more sustainable location – e.g. moving a linear flood defence back from the active coastal zone, providing a more secure position while the shoreline re-adjusts.
- Breaching of existing defences to allow flooding up to higher ground
- Realignment of defences to reduce length maintained or to improve performance

Other approaches, at high-level, generally involve:

- One section of the coast is fixed so that adjacent areas may be managed more naturally without loss of value.
- Where no sensible fixed line to realign to, there is an intent to allow the coast to retreat in a fixed manner.

A Defra study (Halcrow et al., Managed Realignment Review, FD2008, 2002²) looked to identify the constraints and incentives related to the Managed Realignment of flood defences, both on rivers and on the coast. Conclusions of this study, indicated a number of significant challenges associated with policy, and that Managed Relignment projects ‘are always likely to be more complex and time consuming than “classical” defence schemes’.

² http://randd.defra.gov.uk/Document.aspx?Document=FD2008_537_TRP.pdf

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In general, in a populated area with existing hard defences, a walkaway ‘do-nothing’ scenario is likely present unacceptable hazards. Managed Realignment requires ‘decommissioning/relocation’ which carry significant risks/costs that need to be managed carefully over the long-term.

The SMP2 provides limited detail in terms of the suggested approach at Barmouth North Promenade, i.e. proposals should ‘consider widening the overall defence system’ and may ‘require a nearshore or shore connected structures to reduce wave energy but is also likely to require some future realignment of the defence’. It also notes proposals should consider how the northern extents of frontage can be better developed in recognition of both usage and shoreline management. Significantly, the SMP2 acknowledges that of Managed Realignment is likely to incur the loss of properties at North Promenade to allow width for a sustainable flood and coast risk management.

The OBC will explore opportunities for the implementation of the SMP2 policies, as part of the option appraisal process. Considerations of short to medium term adaptive options to the frontage will also be proposed. Any solutions proposed will look to recognise the long-term aspirations of the SMP2.

2.2 Timescales and uncertainties

The DEFRA SMP Guidance (Volume 2: Procedures) (2006) outlines the timescales for the SMP2 analysis and associated policies as:

‘The analysis needs to provide an understanding of coastal evolution within 3 epochs of approximately 0-20 years, 20-50 years and 50-100 years, in response to each baseline scenario. It is recommended that for consistency between SMPs [i.e. SMP1 and SMP2], the output for both baseline scenarios be provided for years 2025, 2055, 2105’

The SMP2 adheres to this guidance, presenting policies for 2025, 2055 and 2105, with the economic assessments for both erosion and flooding damages occurring over the three epochs described. There is a slight discrepancy from these timescales in the SMP2 (Policy Development Coastal Area D: Section 5) which assesses the potential of tidal flood risk in terms of 2010, 2060 and 2110.

However, the SMP2 notes there are ‘uncertainties in terms of the timings of the proposed changes’ for the policy area for Barmouth (M.A. 24 – PDZ11). This is further recognised generally within the SMP2, which identifies ‘in terms of policy change over time, the epochs are necessarily indicative’ and dependant on the rate of sea-level rise. Again, supported by the DEFRA (2006) SMP guidance which states ‘The timing of any change is shoreline management policy, in most cases, cannot be defined precisely’.

Table 2. Preferred Policies (SMP2 PDZ11, 2012)

PREFERRED POLICY TO IMPLEMENT PLAN:	
From present day	Maintain existing defences.
Medium term	Develop strategy to look at opportunities for MR at north Barmouth.
Long term	Maintain defences.

As such, the defined epochs within Table 1 are considered to be less prescribed than indicated, with the policy change seen as a continuous process (as opposed to one step change in approach).

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The SMP2 suggests a strategy to look at opportunities for Managed Realignment should be developed within the medium term (epoch 2), with the policy change occurring over medium to long-term (epochs 2 and 3). It further recognises that there is significant benefit in continuing to manage the frontage (albeit alternative funding sources may be required through integrated planning) and *'in all probability works will be needed to the north Barmouth frontage towards the end of Epoch 1'*.

The appraisal will be based on evidence from modelling of the base year (i.e. 2019), 50-year (i.e. 2069) and 100-year (i.e. 2119) periods. Analysis of results will be used to define the extent of future risks over the medium to long-term.

2.3 Policy Extents

The SMP2 expresses (as outlined) that whilst the frontage at Barmouth is split over three areas, the policies should be considered and *'progressed as one overall area'* – due to the coastal process influences between the areas. The *'manner in which the apex between north Barmouth and south Barmouth is approached needs to be integrating management to both north and south'*.

The flood cell (associated with the inundation modelling, as indicated in the figure below) extends north/south of the indicative study area. Overtopping of the frontage to the north and south of the North Promenade could have a significant impact on flood risk (and associated benefits) associated with the North Promenade. Following issue of the Inundation Modelling Conceptual Note (Arup, 2018) we await YGC's decision on extending the consideration of flood cell overtopping north and south of the study area.

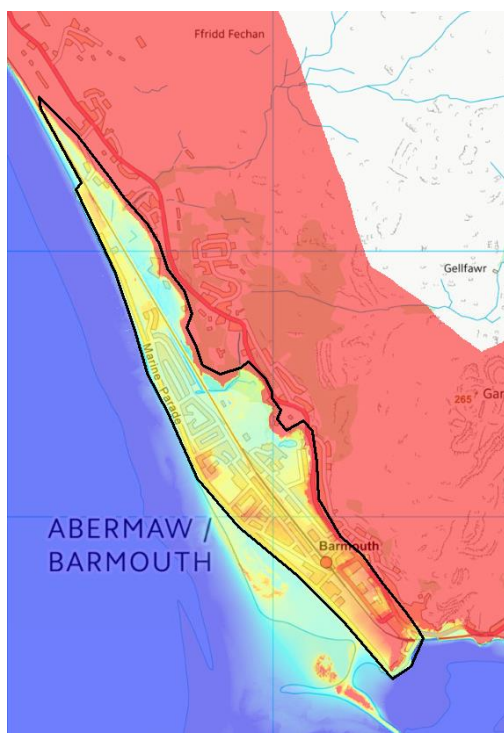


Figure 2. Proposed extent of inundation model and LiDAR ground elevations (i.e. flood cell) (dark blue is 0m AOD and red is above 8m AOD).

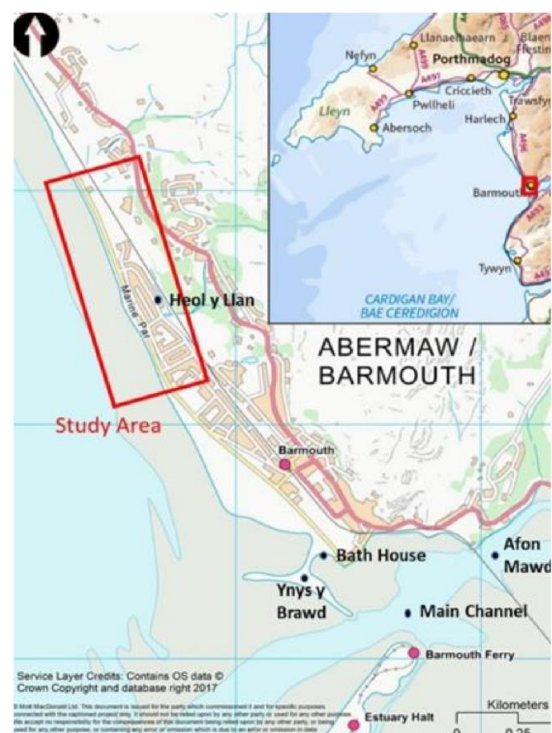


Figure 3. Present study area extents [reproduced from Figure 1-1 in Barmouth North Promenade PAR Review, Mott MacDonald, February 2018]

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Our current scope considers coastal risk management for Policy Unit 11.15. Instruction by YGC is needed as to the degree to which consideration of policy development of adjacent Policy Unit 11.14 and 11.16 should be given, recognising the SMP2 rationale.

DOCUMENT CHECKING (not mandatory for File Note)

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**Appendix B OBC Managed Realignment
Optioneering Note**

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Project title	Barmouth North Promenade OBC	Job number	246326
cc		File reference	
Prepared by	Rosemary Jenkinson	Date	6 March 2019
Subject	Barmouth North Promenade – Do-Something Option: Managed Realignment		

1 Introduction

Ove Arup and Partners (Arup) have been appointed in September 2018 by YGC, part of Cyngor Gwynedd Council (CGC) to deliver an Outline Business Case (OBC) for coastal flood and erosion risk management (FCERM) for the Barmouth North Promenade frontage.

Following the OBC ‘Option Shortlisting Workshop’ on the 22nd January 2019, three ‘Do-Something Options’ were identified from a potential long-list of FCERM measures at Barmouth North Promenade; of which one option includes Managed Realignment. This note looks to set out the option of Managed Realignment and its potential implications within the context of Barmouth North Promenade. It is intended to support the Barmouth North Promenade OBC ‘Economic Case’ and the associated assessment of the shortlist, to inform the selection of a ‘Preferred Option’.

1.1 Scheme context and location

Barmouth is located in Gwynedd on the west coast of Wales, north of the Afon Mawddach estuary. The study extents are defined as ‘Barmouth North Promenade’ as indicated in Figure 1 below. The North Promenade is the northmost section of the Barmouth developed frontage, extending from residential housing estate at Heol y Llan to the northern extent of the promenade wall. The study area comprises a mixture of hard defences, including a vertical sheet piled sea wall, a concrete platform, stone revetment and precast concrete wave recurve wall units, with secondary and tertiary setback walls. The existing coastal defences run parallel with the promenade adjacent to the Marine Parade.

Barmouth North Promenade experiences a number of issues relating to poor asset condition (the existing defences have a number of structural defects), flood risk (including significant overtopping, fluvial and surface water risks) and coastal erosion (overall foreshore bed levels along North Promenade are expected to continue lowering). For further information about the nature of the problem experienced at Barmouth North Promenade please refer to Section 2 of the OBC, which includes details of the appropriate appendices.

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Figure 1. Study extents and key features of note within Barmouth

2 SMP2 Policy Context

The West of Wales Shoreline Management Plan 2 (SMP2) (2011) sets out the policy for coastal risk management across the region. Barmouth North Promenade is located within the SMP2 Management area 24 (MA24) and Policy Unit 15 (Barmouth North) of SMP Sub Cell 9 and Policy Development Zone (PDZ) 11. The current Shoreline Management Plan 2 (SMP2) (2011) policy (Epoch 1) for the frontage of Barmouth North Promenade¹ is to continue to '*hold the line*'. Due to implications of climate change, the present alignment was considered likely to become increasingly difficult to sustain. As such, for the medium and long term the SMP2 recommends a change in approach to '*Managed Realignment*'. Neighbouring SMP2 Policy areas include:

- Barmouth South Promenade: 'Hold the Line'; lies adjacent to the centre of Barmouth and comprises the main amenity beach fronted by vegetated stabilised sand-dunes, Barmouth harbour and the access road to Barmouth.
- Llanaber: 'Hold the Line'; lies northwards comprising a managed shingle bank providing coastal protection to the railway.

¹ Barmouth North Promenade is located within the SMP2 Management area 24 (MA24) and Policy Unit 15 (Barmouth North) of SMP Sub Cell 9 and Policy Development Zone (PDZ) 11.

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Table 1. Summary of specific policies (SMP2 PDZ11, 2012)

MA 24 BARMOUTH: From Porth Aberamffra to Llanaber Point

Policy Unit		Policy Plan			Comment
		2025	2055	2105	
11.14	Barmouth South	HTL	HTL	HTL	
11.15	Barmouth North	HTL	MR	MR	This may include relocation of properties
11.16	Llanaber	HTL	HTL	HTL	This needs to be considered in term of management to the above policy unit.
Key: HTL - Hold the Line, A - Advance the Line, NAI – No Active Intervention MR – Managed Realignment					

All three sections are intrinsically linked - forming a wider flood-cell, with interacting coastal processes. Hence, the SMP2 expresses that whilst the frontage at Barmouth is split over three areas, the policies should be considered and '*progressed as one overall area*'. The present commission only encompasses Barmouth North Promenade, however aims to consider the wider policy contexts.

For further information in-relation to the SMP2 Policy Context for Barmouth, please refer to **Appendix L**.

3 Managed Realignment in the context of Barmouth

The term *Managed Realignment* refers to the realignment of the sea defences to allow a previously protected area of land to be flooded by the tide. Defences can be strategically breached or decreased in height, set back landward, or removed. In many instances, Managed Realignment is typically seen as part of a long-term sustainable strategy to address sea-level rise. It is a relatively new approach, which provides opportunities to maximise wider environmental and socio-economic benefits, through providing new space for coastal habitats to develop.

3.1 Barmouth North Promenade Context

To inform the assessment of Managed Realignment at Barmouth North Promenade, an assessment of the tidal conditions versus the existing elevation and defence levels has been undertaken.

The 2019 ABPmer Coastal Process Assessment² identifies the following tidal conditions.

Table 2. Tidal characteristics at Barmouth (Admiralty Tide Tables, 2018) and Extreme Sea Levels (ABPmer, 2019)

Reference Still Water Level (2019)	mAOD	AEP (%)	RP ³	2019	2060	2119
Highest astronomical tide	3.26	100	1	3.52	3.94	4.62
Mean high water springs (MHWS)	2.25	10	10	3.86	4.24	4.96
Mean high water neaps (MHWN)	1.26	0.1	100	4.15	4.57	5.25
Mean sea level (MSL)	0.28	0.5	200	4.24	4.66	5.37
Mean low water neaps (MLWN)	-0.54	0.01	1000	4.43	4.85	5.53
Mean low water springs (MLWS)	-1.74	Adjusted to represent sea-level rise as per Welsh Government (2017) climate change guidance ⁴				
Lowest astronomical tide (LAT)	2.14					

² Please refer to Barmouth North Promenade: Appendix C

³ Return Period

⁴ Welsh Government, (2017). Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales

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A typical long-section of elevation levels (mODN) has been extracted from publicly available LiDAR⁵ information, as indicated below. It is evident that the North Promenade and Cambrian Railway are set on man-made raised elevations. The natural profile is assumed be similar to that of the low-lying land behind the Cambrian Railway extending towards the shorefront.

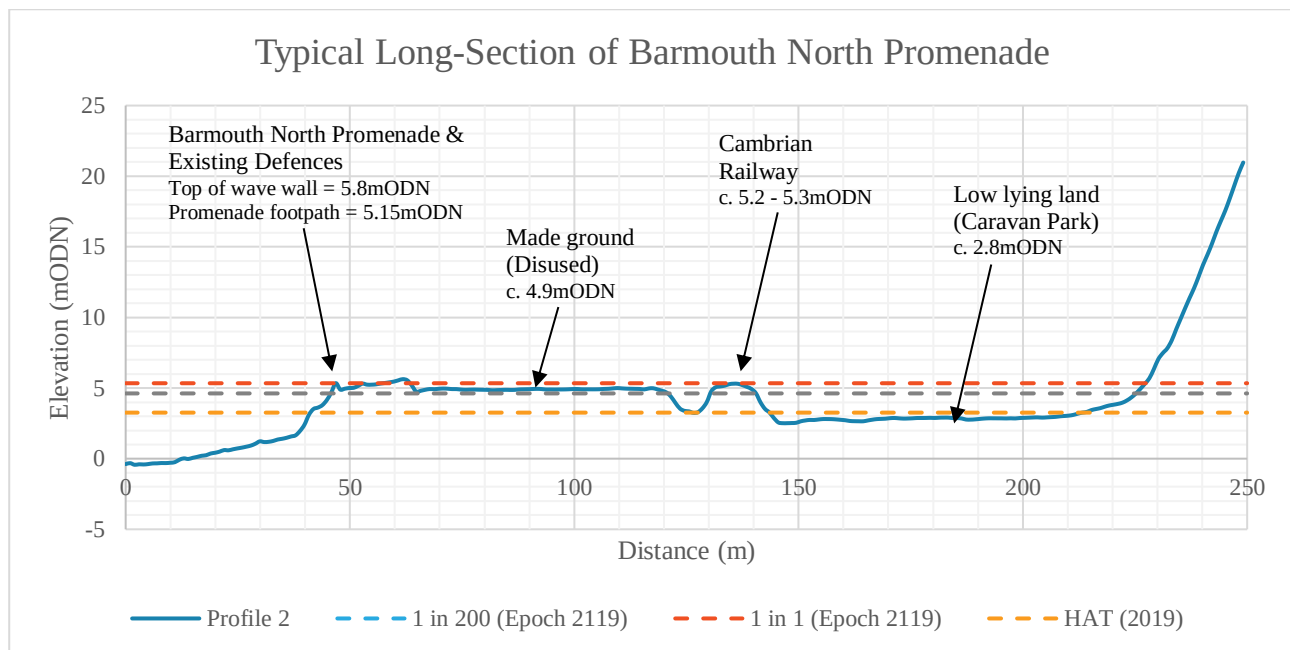


Figure 2. Typical long-section of Barmouth North Promenade (section parallel to Groyne 32, as per Figure 1)

Considering the above, several key risks associated with Managed Realignment are evident:

- Should the defence alignment be realigned, the Cambrian Railway and low-lying land behind the caravan park will become increasingly susceptible to tidal flooding and overtopping risks, particularly during storm events, over the 100-year appraisal period. This poses risks to the wider flood cell encompassing the neighbouring SMP2 'Hold the Line' Policy Areas of Barmouth South and Llanaber. Further interventions will be required, as discussed further below.
- The Arup (2019) Geotechnical Desk Study⁶ indicates the superficial deposits along the alignment of the promenade comprise Blown Sand, with 'sand fill' was placed beneath the Promenade to raise the ground level and this is likely to be locally sourced. Sandy soils are generally highly susceptible to wash out, particularly if they have a low fines content (silt and clay). As such, rapid erosion of the existing levels (from 40-140m) is expected to occur should a Managed Realignment approach be undertaken. It is expected an additional line of defence would be required to protect the Cambrian Railway, assets beyond this point and the neighbouring SMP2 'Hold the Line' Policy Areas.
- As the Promenade is set higher than present tidal levels (i.e. max. HAT, not considering future sea-level rise), significant land lowering and excavation would be required to promote or create inter-tidal habitats.

⁵ DTM LiDAR (1m resolution) (Source: uk.gov)

⁶ Please refer to Barmouth North Promenade: Appendix D

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3.2 Type of Managed Realignment

As indicated above, Managed Realignment can take a wide variety of forms. To determine the most appropriate approach, the table below considers the different types of schemes and their appropriateness to the Study Area.

Table 3. Type of Managed Realignment

Type of project ⁷	Assessment for Barmouth North Promenade
Bank realignment: involves the deliberate removal of existing defences or embankments to allow the waters of adjacent coasts or estuaries to inundate the land behind. This can involve: - Constructing a new flood defence line inland of the original - Promoting the creation of new areas of habitat - Removing the front sea wall either partially or wholly	Barmouth North Promenade sits within a wider urban flood cell, with significant strategic assets (e.g. the Cambrian Railway Line). As such, the construction of a new flood defence line inland of the original is required to afford appropriate protection to the neighbouring SMP2 policy units and key assets. It is envisioned the existing defences would need to be removed (wholly or partially) to ensure public safety in, what is, a popular coastal resort.
Breach: Involves deliberately breaching sections of the existing defences to allow waters to inundate the land behind through a defined gap. Controlled abandonment: Initial active management is undertaken (e.g. creation of new areas of habitat behind the defence line). Following which once natural defences have become established, maintenance of the existing is discontinued and they are allowed to fail.	Due to the presence of the Cambrian Railway Line and adjacent residential properties, a new defence alignment is required (as identified above). Hence, breaches, regulated tidal exchange are considered to be inappropriate. These approaches are likely to cause significant risks to the safety of the general public and local communities. Controlled or uncontrolled coastal flooding designed to occur behind the existing defences, will increase flood risk and risk to life to unacceptable levels for those living and working neighbouring the defences. In most cases, the approaches outlined are most suited to schemes where the primary purpose or main driver of the works is the creation of new intertidal habitats for ecological benefits. This is not considered to be the case at Barmouth North Promenade, where the primary objective is to manage flood and coastal erosion risk in an urban area – including Barmouth South.
Regulated tidal exchange: Encompasses a range of techniques for intertidal habitat creation beyond breaching of the existing defence line (e.g. sluice gates, weirs, pipes) to control regular tidal inundation. The old defence line requires maintenance.	As identified above, approaches which control tidal inundation without a supporting defence alignment are considered inappropriate in this context. Furthermore, as land-levels are higher than existing tidal levels, this limits opportunities for inter-tidal habitats without further land-lowering activities.

3.3 Extents of Managed Realignment

Within the context of a bank realignment approach, there are a series of locations (or extents) to which the defences could be set-back or realigned. Each with differing implications, which are examined below.

⁷ Source: Environment Agency, SC080039/R8, 2015

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Table 4. Extents of Managed Realignment

Bank realignment	Considerations (+) or (-)
Option 1: Defence-line set back to the Caravan park	(+) Most opportunity for creation of habitats (noting limitations as outlined) (-) Impacts on wider policy areas of Barmouth South and Llanaber. (-) Loss of significant resident properties and the caravan park. (-) Requires the loss or diversion of the Cambrian Railway. This is a strategic transport link - a diversion would be of major cost or its would have significant economic and social implications. <u>This approach is not considered appropriate.</u>
Option 2a: Defence-line set back to the Cambrian Railway transitioning into Barmouth South (as indicated in Figure 3 below)	(+) Affords protection to the Cambrian Railway (+) Habitat creation opportunities (although minimal, due to tidal levels < existing land levels) (-) Loss of existing residential properties – both economic, social and political implications for local communities. (-) Relocation of existing community - noting uncertainty around appropriate compensation/relocation funding mechanisms. (-) Relocation of existing recreational facilities (i.e. skatepark, Promenade Café) and car-parking facilities at the northern extents of the promenade.
Option 2b: Defence-line set back to the Cambrian Railway + existing extents affording protection to the Hoel-Y-Llan Housing Estate are maintained (as indicated in Figure 3 below)	(+) Affords protection to the Cambrian Railway (+) Affords protection to existing properties and maintains spatial extents of existing communities (-) Minimal habitat creation or observable benefit achieved due to limited extents of retreat. As above, tidal levels < existing land levels restrict opportunities for inter-tidal habitats. (-) Likely to require additional structures (e.g. rock groynes) or measures to the existing defences to ensure protection is maintained to the housing estate over the 100 year appraisal period. This will increase option costs. Uncertainties around the extent to which the estate can be protected. (-) Relocation of existing recreational facilities (i.e. skatepark, Promenade Café) and car-parking facilities at the northern extents of the promenade.

Figure 3 defines indicative extents for Managed Realignment at Barmouth North Promenade (Option 2a and Option 2b):

- The Option 2a extents are defined as per the 2011 SMP2 indicative policy boundary for Barmouth North Promenade. This indicates protection afforded to the Cambrian Railway, whilst a series of properties would be affected within the Hoel-Y-Llan Housing Estate.
- Option 2b affords protection to the housing estate through the existing defence line. This approach would effectively compartmentalise the study area into two spatial schemes: ‘Managed Realignment’ to the north, and ‘hold the line’, i.e. betterment and maintenance of the existing defences, to the south. This approach is likely to require beach management activities (i.e. groynes and beach renourishment) to the remaining extents (i.e. dotted green line).

Further option development and assessment is required to define the most appropriate extents. This needs to be supported by on-going stakeholder consultation and input/direction from YGC.

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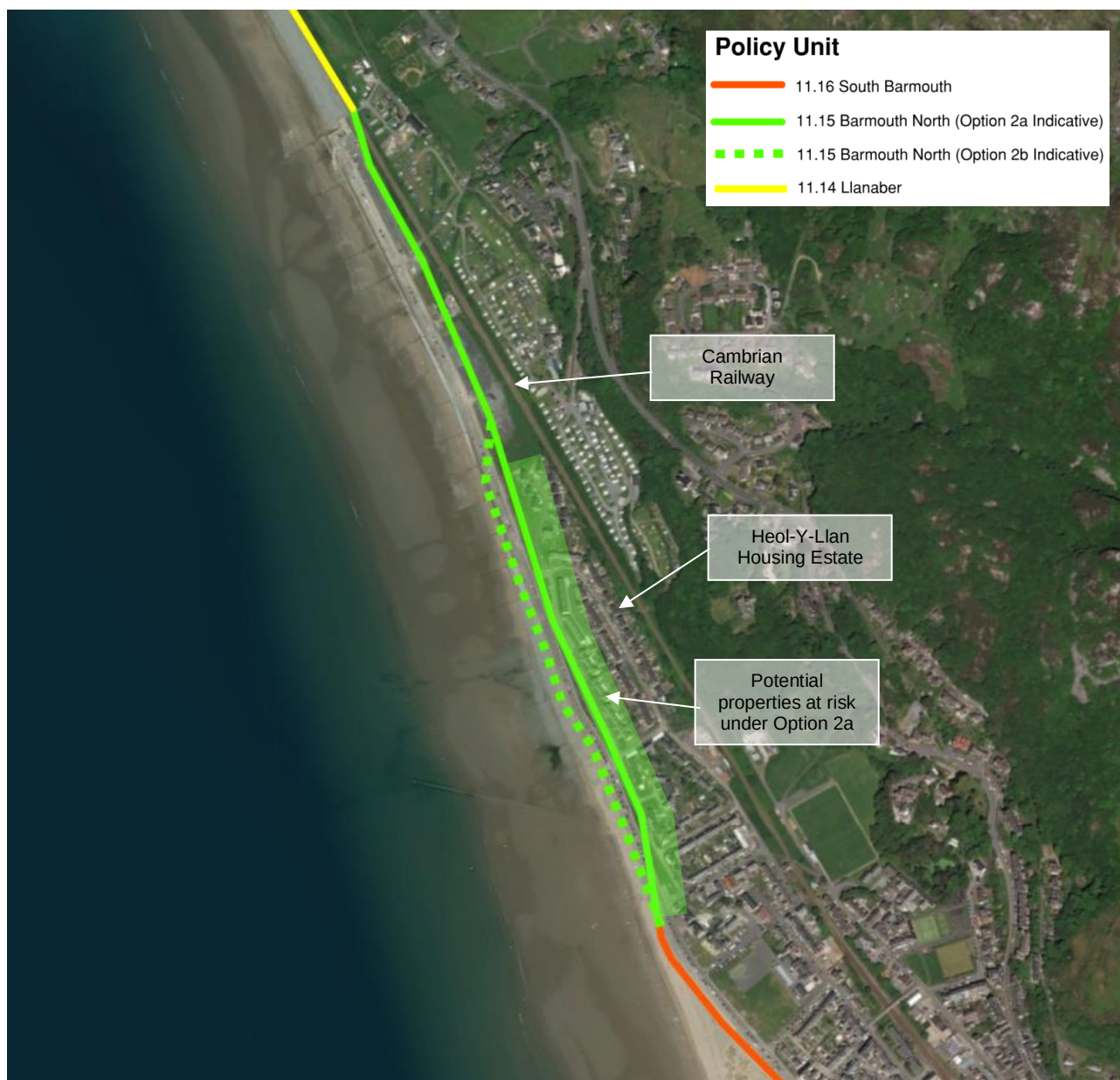


Figure 3. SMP2 Policy Extents and potential extents for managed realignment

3.4 Timing of Managed Realignment

The SMP2 notes there are '*uncertainties in terms of the timings of the proposed changes*' for the policy area for Barmouth (M.A. 24 – PDZ11). As recognised generally within the SMP2, the defined epochs within Table 1 (above) are considered to be less prescribed than indicated, and dependant on the rate of sea-level rise. The policy change is seen as a continuous process (as opposed to one step change in approach).

With the overtopping and inundation modelling assessments in **Appendix B**, indicating over the longer-term it is likely to become economically unfeasible to defend the frontage. This presents two pathways to implementation:

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- An adaption pathway approach, which considers investing in a scheme to extend the life and/or provide an increased standard of protection along frontage now, moving to Managed Realignment over the longer-term. This would extend the life of the frontage for as long as is considered practical (e.g. up to Epoch 3). However, will increase costs through requiring significant capital expenditure (e.g. equivalent of an FCERM scheme) before Managed Realignment is implemented.
- An adaption pathway approach, which limits activities to the existing defences and supports a move towards Managed Realignment. Timing based on monitoring of frontage (e.g. deterioration of existing defences) and sea-level rise/overtopping experienced. This is likely to be of lesser capital costs, however brings forwards the onset of Managed Realignment towards Epoch 2.

Further discussion with YGC and key stakeholders (e.g. Network Rail) is required to define the preferred approach.

4 Impacts

The impacts of Managed Realignment at Barmouth North Promenade are outlined further below.

4.1 Engineering Performance

Managed Realignment is seen as a means of providing long-term sustainable and effective flood and coastal erosion defence. Presently, significant overtopping is experienced at the northern extents of the promenade. This will increase in severity over the 100 year appraisal period, due to climate change and sea-level rise, for example:

- Overtopping rates 2019: 163 l/s/m for a 0.5% AEP (1:200 year)
- Overtopping rates 2119: 255 l/s/m for a 0.5% AEP (1:200 year) (*i.e. + 54% for this AEP*)⁸

With the significant volumes of overtopping experienced at Barmouth North Promenade anticipated to increase, over the long-term it is likely to become un-feasible to continue defend the frontage with significant capital and operational expenditure in defence structures and beach management. In this instance, Managed Realignment provides the only means of ensuring a sustainable and effective flood and coastal erosion strategy. This is not without significant economic and wider implications, as discussed further below.

The standard of protection achieved by Managed Realignment is expected to be defined by the new line of defence. It is envisioned a standard of protection of 0.5% AEP (1:200year) + CC would be achievable for the remaining study extents. Depending on the extents of Managed Realignment and residual risk, works likely to be involved are outlined in the following table and detailed in a sketch in **Appendix I**.

⁸ Appendix B: ABPmer (2019) Wave Modelling, Extremes Analysis and Overtopping

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Process	Option 2a: Defence-line set back to the Cambrian Railway transitioning into Barmouth South	Option 2b: Defence-line set back to the Cambrian Railway + extents of the Hoel-Y-Llan Housing Estate
Pre-Construction Costs	Initial design, management and administration costs; including surveys, extensive and on-going stakeholder (e.g. Local Housing Authorities, Network Rail) and community engagement by the Local Authorities.	
	Likely to require more intensive stakeholder engagement costs due to the requirement for compensation / relocation of existing residential properties.	Extensive works will need to be undertaken to define the standard of protection achievable to the existing residential properties and managed associated risks.
Monitoring	Monitoring and review activities associated within any adaption pathway approach implemented. Monitoring is required prior to construction, during construction and inundation and post-works.	
Decommission Activities: Extended sections of coastal defence are removed or to be made safe for the general public. <i>Otherwise, access will need to be restricted.</i>	- Removal or decommissioning of the existing defences (including sheet pile) and groyne structures throughout the study extents - Decommissioning of highway and promenade features	- Removal or decommissioning of the existing defences (including sheet pile) and groyne structures – only up to groyne 28 (i.e. 40% of existing defences) - Decommissioning of highway and promenade features
Project involves new line of defence or upgrading of existing defences	- New line of defence along the Cambrian Railway and Heol-Y-Lan housing estate - Replacement of two watercourse outfalls – including pumping station and outfall, and culverted watercourse	- New line of defence along the Cambrian Railway - Replacement of north watercourse culvert and associated storage - Works to extend the life-span and enhance the standard of protection of the existing defences to the south of the study extents (i.e. protecting the Heol-Y-Llan - May require additional structures (e.g. rock groynes) at the transition point between the new line of defence and the Heol-Y-Llan housing estate. - May require beach management activities (i.e. groynes and beach nourishment) to the remaining southern extents
Planned removal of people and assets at risk	- Land acquisition costs for land behind the defences - Compensation / relocation of Promenade Café and Car Park Owner - Compensation / relocation of residential property owners	- Land acquisition costs for land behind the defences - Compensation / relocation of Promenade Café and Car Park Owner
Operational and Maintenance	On-going operational and maintenance activities along new line of defence.	

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Table 5. Activities associated with Managed Realignment

4.2 Economic Performance

Of significant cost and associated risks, particularly in terms of the removal of the existing defences and relocation of existing residential properties. Please refer to OBC Appendix A: Economic Appraisal Report for a summary of the financial performance of this option.

Wider Economic Considerations:

Environmental: It is notable that the SMP2 policy of Managed Realignment is most likely to be beneficial in areas of low agricultural land or where the topography and neighbouring land-uses minimise the need for additional defences. In most instances, Managed Realignment is used to restore or create tidal habitats (e.g. salt marshes) compensating for habitats lost to development or coastal squeeze. Such creation can provide significant economic benefits, including ecosystem services such as recreation, enhanced carbon sequestration and improved biodiversity. Due to the limited extents of Managed Realignment the benefits achievable are considered to be limited.

Social, Well-Being and Recreation: Please refer to Section 4.4 for further details. The impacts outlined will have an economic cost on the area of Barmouth. With respect to the loss of recreational value of Barmouth North Promenade, the construction of a new defence line and loss of land should be examined to identify wider opportunities available.

Existing Defences: In general, in a populated area with existing hard defences, such as Barmouth, Managed Realignment requires 'decommissioning/relocation' which carry significant risks/costs that need to be managed carefully over the long-term.

Stakeholders: The Cambrian Line is a railway that runs from Shrewsbury to Aberystwyth and Pwllheli, both on the west coast of Wales. Whilst boasting scenic views, the Cambrian Line also provides a strategic public transport link to a number of coastal towns in Wales, including Barmouth, for both tourists, residents and businesses. The line is owned and maintained by Network Rail, who presently undertake works to maintain protection in the adjacent SMP2 Policy area of Llanaber. Realignment of the defences (set back landward) will increase the risk of the asset to tidal and overtopping flood risk, beyond existing baseline. This is likely to pose a negative economic or financial implication on Network Rail.

4.3 Environmental Performance

The managed re-alignment of the foreshore would lead to some loss of the existing hinterland habitat, while this would need to be considered and assessed, the existing habitat is generally of low ecological value being largely developed. The re-alignment option would lead to a change in the existing conditions within the adjacent Pen Llyn ar Sarnnau SAC. Whilst these changes would need to be fully understood as part of the HRA, they could potentially be deemed to be of conservation benefit to the SAC through the creation of a more natural bay feature and associated intertidal habitats. The extents to which habitat creation can be achieved appear to be constrained by the limited land gained seaward as a result of the realignment.

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4.4 Social & Well-Being

As detailed in Barmouth North Promenade OBC: **Appendix I**, each of the Do-Something Options (including Managed Realignment) have been assessed against the Welsh Government Future Generations (Wales) Act seven well-being goals and five ways of working.

In summary, Managed Realignment could involve the loss of local residential and commercial properties (including the Heol-Y-Llan Housing Estate). This is likely to have negative implications on the local communities' health (e.g. mental health and stress, particularly for vulnerable residents), community cohesion (e.g. dissatisfaction and split of treatment between Barmouth North and South) and loss of local culture. In particular, the Heol-Y-Llan Housing Estate is largely comprised of housing association properties. The loss of such assets is likely to impact some of the most vulnerable in society (e.g. low-incomes) and removes a series of affordable housing from the local area.

Although potentially minor compared to Barmouth South, there are likely to be recreational losses associated with the amenity of the promenade - footpath and National Cycle Route, the local skatepark, Promenade Café and car-parking facilities.

During the public consultation event (25th March, 2019), residents highlighted the full length of the promenade is considered a significant asset – both in terms of both in attracting tourists (main economy of the town) and providing amenity value for local residents and their wider families and grandchildren (beyond Barmouth). The northern extents are frequently used (daily) by locals for recreation, exercise, dog walking, land-train horse-riding and access to the beach. Implications on the North Promenade are seen as likely to impact on the wider town of Barmouth and the tourist economy.

Residents further highlighted the car-parking facilities to the northern end of the town are considered vital. Local residents noted they experience issues with overcrowding of tourists and lack of parking facilities during the summer months. Without the northern promenade this would exacerbate issues further.

Any future scheme should look to incorporate recreational and amenity features where possible, to negate any losses experienced. For example, inclusion of a promenade or community installations within the design, improving or enhancing public access to the foreshore or assess opportunities for car-parking facilities.

4.4.1 Community Engagement

The importance of getting the community involved and supporting the scheme at an early stage has been highlighted, both within a DEFRA 2008 study⁹ and local events at Fairbourne - where Managed Realignment is a policy being taken forward. The objective should be to engage the community in a way that enables a real input to shaping the scheme whilst not opposing a decision for Managed Realignment. Through taking a pro-active approach and informing the local community from the onset, the associated negative implications on health (e.g. mental health), culture and community cohesion can be minimised.

On 25th March, YGC undertook an initial consultation with the local residents and business owners on the shortlisted elements of the scheme so far. Approximately 47 people were in attendance, and attendees noted their concern about an option of managed retreat which involves the loss of the

⁹ DEFRA/EA Flood and Coastal Defence R&D Programme, Managed Realignment Review, 2008

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promenade. They highlighted their interest in being kept informed of the activities going forwards. It is recommended that YGC continue their engagement with the local community to keep them up to date with the OBC outcomes, next steps and anticipated programme going forward; particularly if Managed Realignment is taken forward as an element of the preferred option.

4.5 Political & Financial Performance

Policy Context: Barmouth North Promenade is identified as a Coastal Change Management Area (CChMA), within the Anglesey and Gwynedd Joint Local Development Plan (JLDP) (2016-2026). This means there are a number of planning restrictions on new, replacement or relocated developments (both residential and non-residential). Importantly, it is noted that no new residential buildings will be granted planning permission within Barmouth North Promenade, and non-residential developments will only be permitted within the second indicative SMP2 policy epoch (2026-2055), subject to further assessments. This means that beyond the existing life-span of the structures at present, there is expected to be limited new development. Over the longer-term, this is likely to lead to a natural decline in the Study Area, as existing dwellings cease to be replaced, and support the ambitions to move towards Managed Realignment.

Financial & Funding: There are number of obstacles to Managed Realignment. In a DEFRA 2008 study¹⁰ a key constraint identified was the *“lack of financial compensation (which in this context includes both land purchase and payment for the use of land) as the biggest obstacle to Managed Realignment. Under present legislation, landowners do not generally have any right to financial compensation where a decision is made to no longer defend their land”*. With compensation deemed a major barrier to implementing Managed Realignment, it is hard to envisage local public support unless it is felt that the cost of realignment has been shared equably. An alternative to providing individuals with compensation is to provide or incentivise relocation. Should this option be pursued, YGC are likely to need to investigate funding mechanisms for compensation and/or relocation of those affected with Welsh Government.

It is noted that wider funding opportunities may exist through the lens of habitat creation, and YGC should explore these with external environmental organisations to maximise any opportunities. Wider funding opportunities promoting recreational and social benefits should further be considered.

Political: A scheme which involves the loss or relocation of any properties is likely to be controversial or provoke strong local opinions, leading to significant risks to the future of a scheme and local community cohesion. With the neighbouring scheme at Fairbourne of ‘Managed Realignment’ in progress, any lessons learnt should be applied directly to Barmouth North Promenade and as noted above, early stakeholder consultation and a public education programme is a priority.

5 Key Risks

There are a number of key risks associated with the implementation of Managed Realignment, the main ones of which are highlighted below:

¹⁰ DEFRA/EA Flood and Coastal Defence R&D Programme, Managed Realignment Review, 2008

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- Implications of neighbouring SMP2 Policy Areas: The scheme will need to be defined to ensure the existing flood and coastal erosion protection afforded to the neighbouring SMP2 Policy Units is maintained. Particularly, Barmouth town towards the south.
- Capital Expenditure: significant risks are associated with the capital expenditure required, particularly considering:
 - Construction of new, and removal of the existing, defences. There are significant uncertainties with the scale, extent and cost of the activities associated. Extensive pre-construction works are likely to be required to manage this risk.
 - Compensation or relocation of those affected by the extents of the Managed Realignment proposed.
- Timings of Managed Realignment: the residual life-span of the existing structures is considered to be <10-20 years at the northern extents of the frontage. Significant storm events may accelerate deterioration. On-going monitoring will be required to ensure action is undertaken at an appropriate point to afford protection to the local residents and businesses in Barmouth. A substantial and robust Adaptive Pathway Approach should be developed.
- Overtopping and residual risk: Work will need to be undertaken to define overtopping and residual risks from the new line of the defence to the Cambrian Railway, the adjacent caravan park and the Heol-Y-Llan housing estate. Residual risks may be encountered and may define the proximity of structures adjacent to the defences. The existing fluvial outfalls will need to be replaced, with studies to ensure that associated flood risks are not increased.
- Public Safety: Significant works (including capital and operational expenditure) will be required to ensure the scheme and the associated structures are safe to general public. Otherwise access will need to be restricted.
- Surveys: Extensive engagement and surveys are likely to be required to ensure any below-ground assets have been identified and can be lost/diverted as part of the scheme.

6 Summary

Table 6. Summary of Managed Realignment at Barmouth North Promenade

Summary of impacts:	
Engineering Performance	Opportunity to provide a long-term sustainable FCERM scheme at Barmouth North Promenade.
Economic Performance	Of significant cost and associated risks, particularly in terms of the removal of the existing defences and relocation of existing residential properties. There is a perceived limited gain, for significant financial expenditure.
Environmental Performance	Potential opportunities to promote habitat creation, although this is considered to be limited.
Social & Well-Being	Potential negative implications on local residents and businesses, particularly without adequate consultation and support structures to facilitate Managed Realignment.
Political & Financial Performance	Significant risks associated with funding structures and mechanisms.

File Note

246326

6 March 2019

File Note

246326

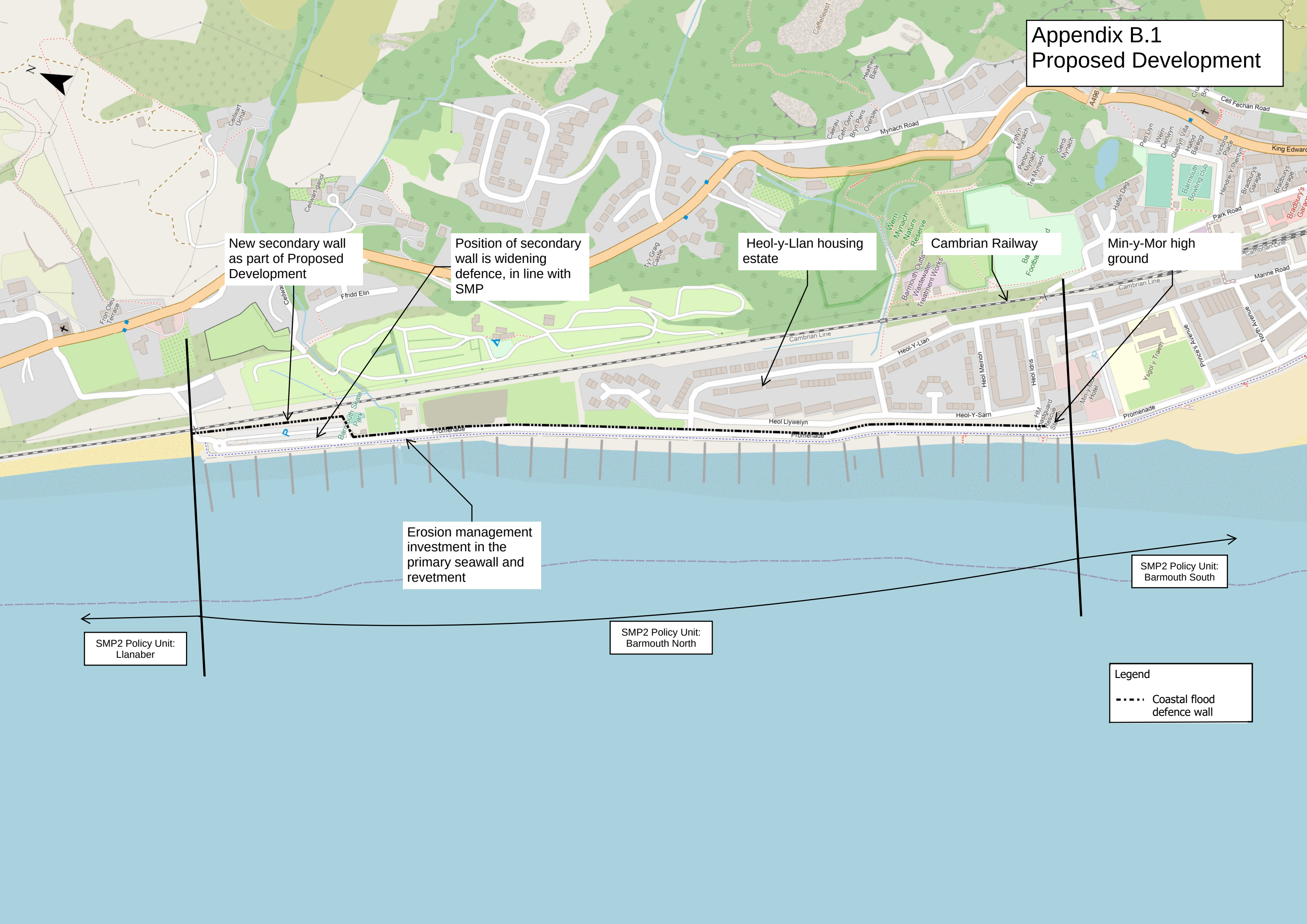
6 March 2019

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Rosemary Jenkinson	Robin Campbell	
Signature			

Appendix C Managed Realignment Options

Appendix B.1 Proposed Development



New secondary wall
as part of Proposed
Development

Position of secondary
wall is widening
defence, in line with
SMP

Heol-y-Llan housing
estate

Cambrian Railway

Min-y-Mor high
ground

Erosion management
investment in the
primary seawall and
revetment

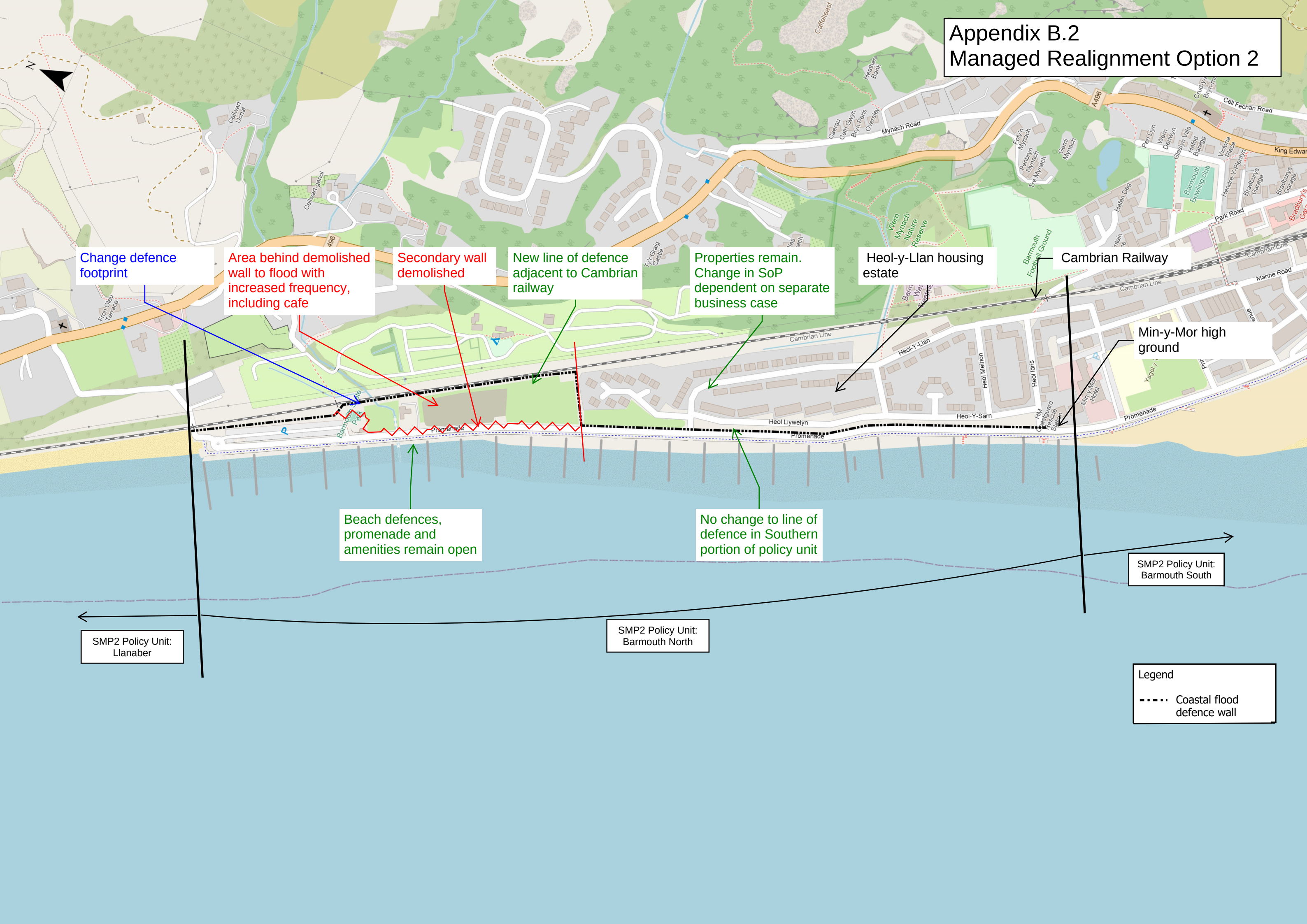
SMP2 Policy Unit:
Barmouth South

SMP2 Policy Unit:
Llanaber

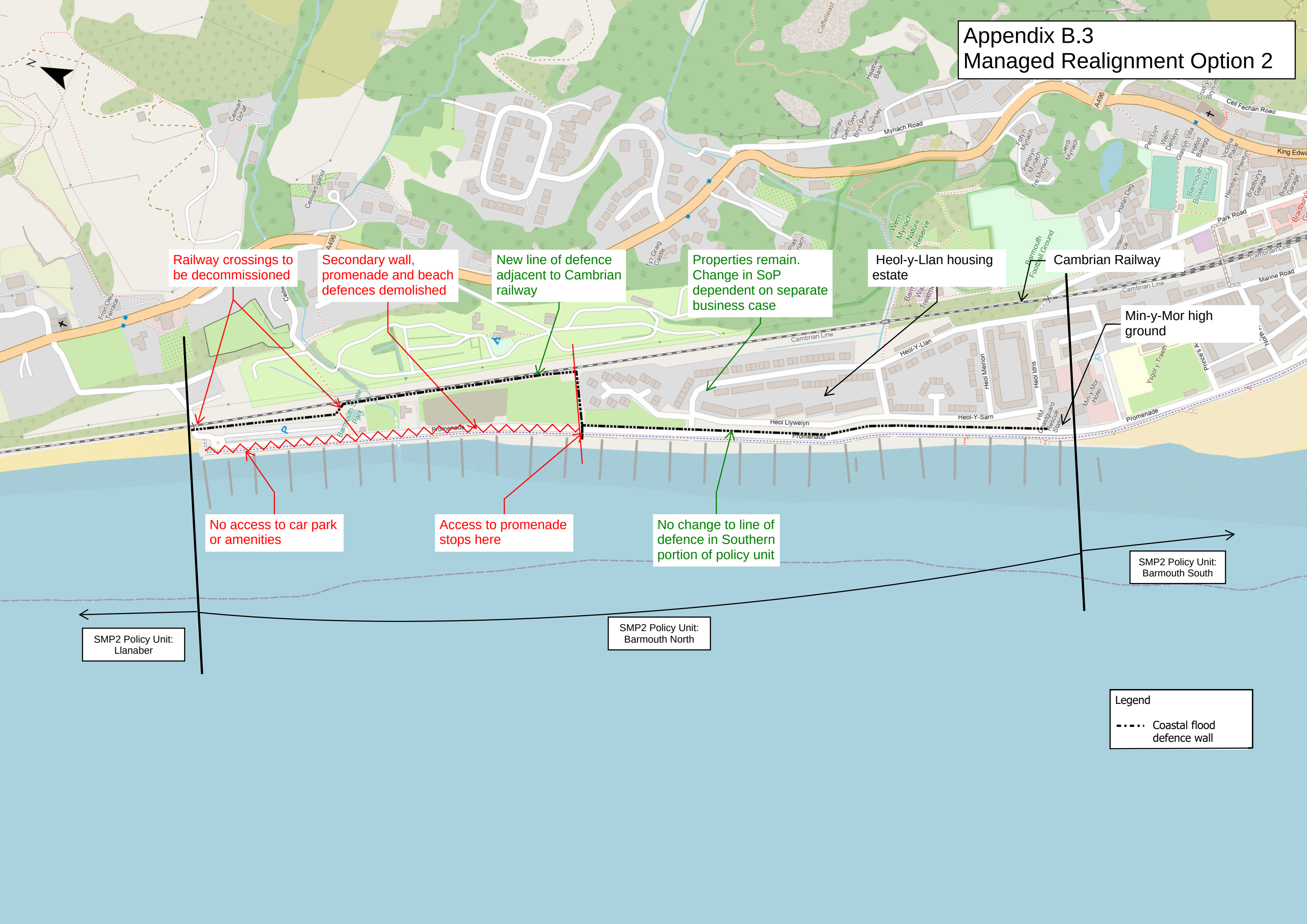
SMP2 Policy Unit:
Barmouth North

Legend
- - - - Coastal flood
defence wall

Appendix B.2
Managed Realignment Option 2



Appendix B.3
Managed Realignment Option 2



Railway crossings to be decommissioned

Secondary wall, promenade and beach defences demolished

New line of defence adjacent to Cambrian railway

Properties remain. Change in SoP dependent on separate business case

Heol-y-Llan housing estate

Cambrian Railway

Min-y-Mor high ground

No access to car park or amenities

Access to promenade stops here

No change to line of defence in Southern portion of policy unit

SMP2 Policy Unit: Barmouth South

SMP2 Policy Unit: Llanaber

SMP2 Policy Unit: Barmouth North

Legend
- - - - Coastal flood defence wall

Appendix B.4

Epoch 3 - Hold the Line

New secondary wall
as part of Proposed
Development

Position of secondary wall is widening defence, in line with SMP

Consider raising secondary wall in this section or entire length

Heol-y-Llan housing estate

Cambrian Railway

Min-y-Mor high ground

Measures to prevent
outflanking of defences
may be required

Erosion management investment in the primary seawall and revetment

Consider raising primary wave wall in this section or entire length

SMP2 Policy Unit:
Bournemouth South

SMP2 Policy Unit:
Llanaber

SMP2 Policy Unit:
Barmouth North

Legend

----- Coastal flood
defence wall

**Appendix D West Wales Coastal Group
Presentation July 2025**

Barmouth North Promenade

West Wales Coastal Group

Robin Campbell and Philip Smith

16/07/2025

Agenda

- Recap from September 2024 Coastal Group SMP2 Policy Context and OBC
- Emerging FBC design
- Detail and challenges around SMP2
- Discussion and conclusion

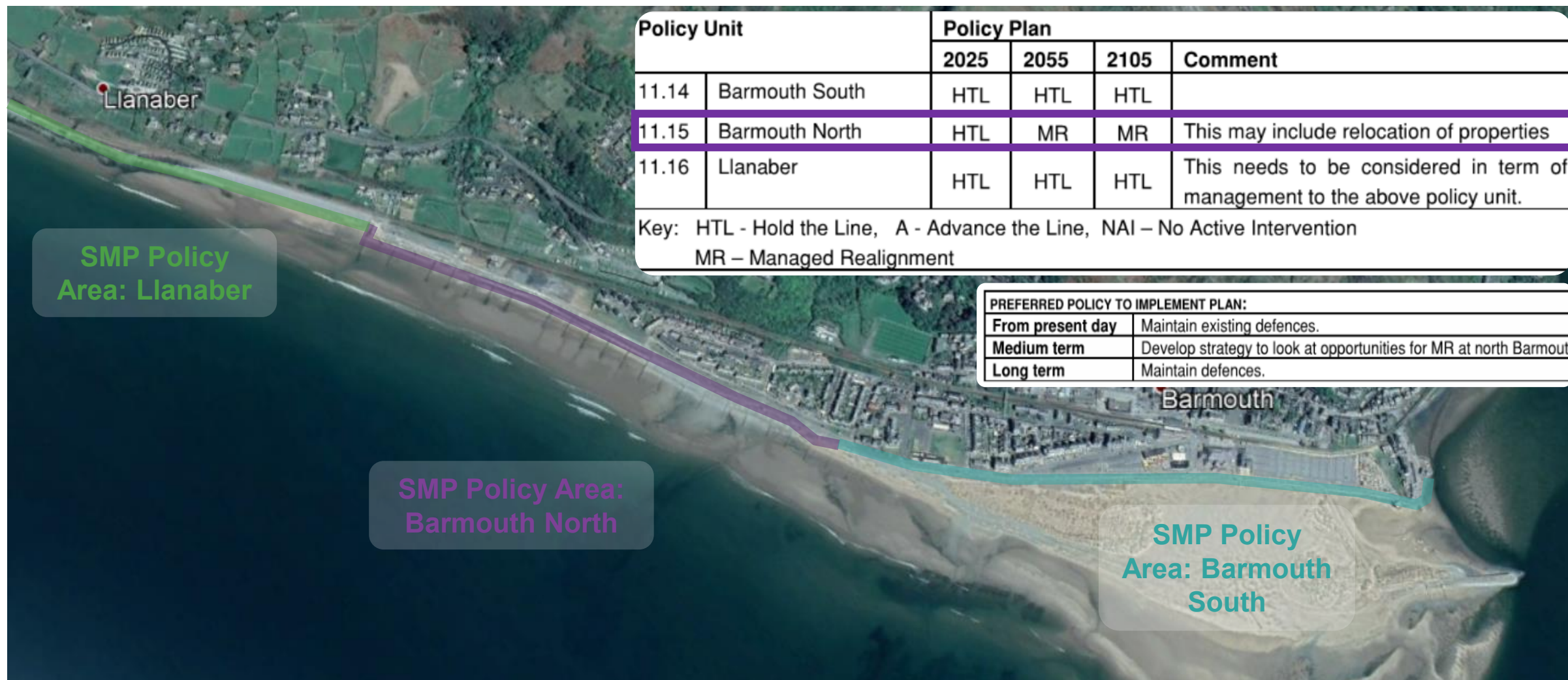
Recap

SMP2 and Policy Context

Project Area



SMP2 Policy



OBC Overview



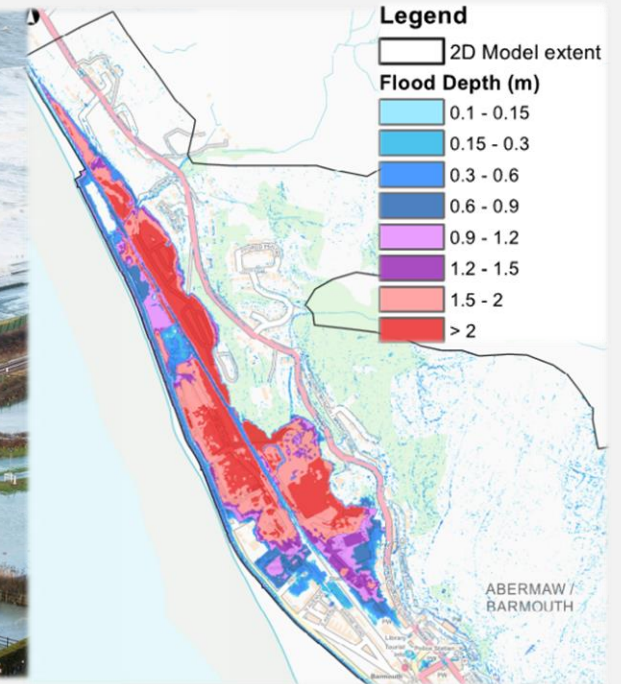
Challenges

Failing
assets

Risk to life

Flood &
erosion
risk

Climate
change



Objectives

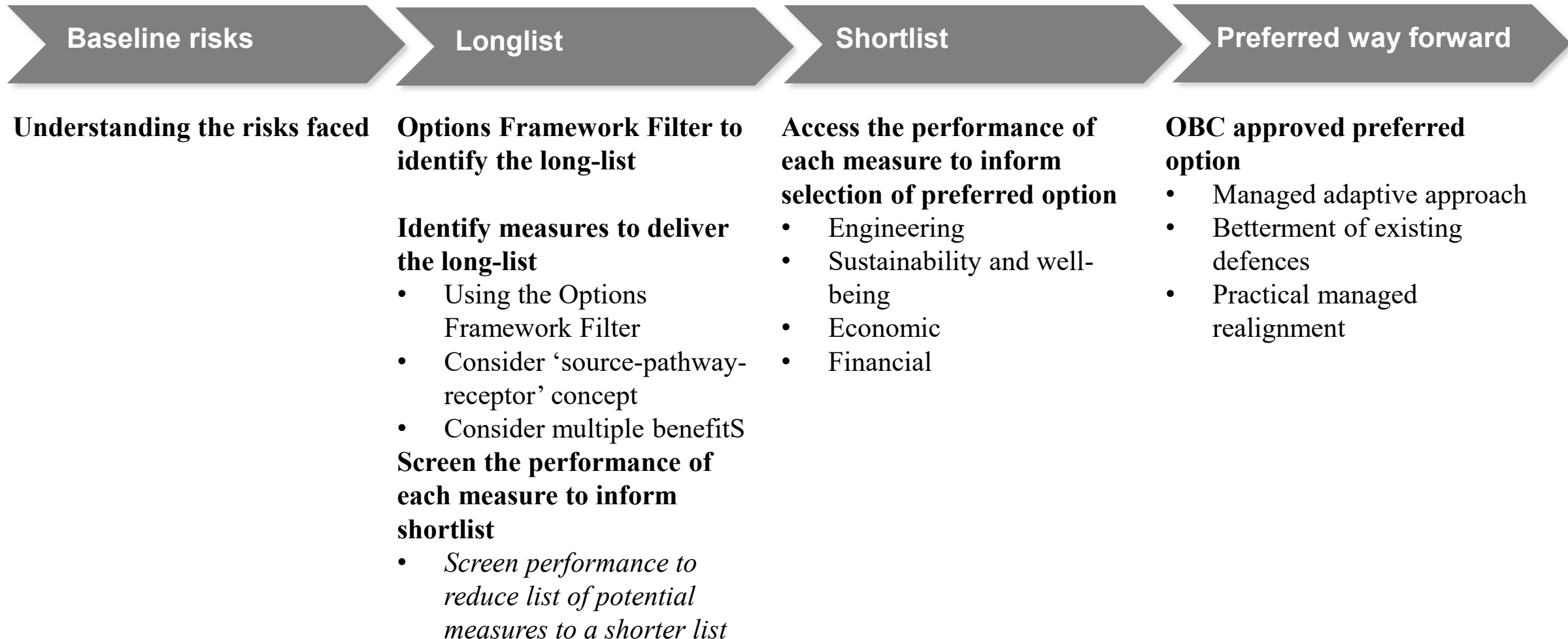
Cyngor Gwynedd sought a solution to:

- Reduce coastal flood and erosion risk to Barmouth North Promenade
- Improving the amenity and environmental value of this section of coastline
- Safeguard local community and tourism economy

SMART	Objective description
1	To reduce the threat of coastal flood and erosion risk to people and property with due consideration of SMP2 policy to ensure the long-term resilience and vitality of the community.
2	To support, and where possible enhance, recreation and amenity value of the local area
3	To maintain, and where possible enhance, the environment.
4	To ensure marine amenity activities can continue to grow.
5	To ensure an affordable and deliverable whole life option through a partnership approach and contributions

No	Critical Success Factor
1	Strategic Fit and Business Needs
2	Potential Value for Money
3	Supplier Capacity and Capability
4	Potential Affordability
5	Potential Achievability

OBC Approach



Proposed approach

How to make the best use of existing assets as an adaptive pathway approach

- Delivering resilient solutions in the face of changing uncertainty
- Managed adaptive approach involves investing now in actions that manage today’s risks, monitoring the change in risk over time and managing these changes.
- Involves planning for multiple interventions and investments in the future, although the future choices and the timing of these interventions will be uncertain



	Epoch 1 0-20 years	Epoch 2 20-50 years	Epoch 3 50-100 years
Pathway A	Option 2: Betterment of defences		Option 4: Managed Realignment (SMP2)
Pathway B	Option 2: Betterment of defences	Option 4: Managed Realignment (SMP2)	
Pathway C	Option 2: Betterment of defences		Option 3: Beach Management
Pathway D	Option 2: Betterment of defences	Option 3: Beach Management	
Pathway E	Option 3: Beach Management		
Pathway F	Option 2 + Option 3		
Pathway G	Option 2: Betterment of defences		Option 4b: Managed Realignment (North)
Pathway H	Option 2: Betterment of defences	Option 4b: Managed Realignment (North Only)	

West of Wales Shoreline Management Plan (2011)

Short-term, the frontage is 'hold the line'.	Medium / long-term change in approach to 'managed realignment':
Due to implications of climate change, the present alignment was considered ' <i>likely to become increasingly difficult to sustain</i> '.	<i>'Consideration should be given to widening the overall defence system in this area. This may require nearshore or shore connected structures to reduce wave energy but is also likely to require some future realignment of the defences, quite probably with the loss of property. This would require a more integrated approach to management, considering how the northern seafront could be developed to better advantage both in term of use and shoreline management.'</i>

- The **SMP timescales are less prescribed than indicated**, with the policy change seen as a continual process.
- The **SMP2 suggests opportunities for Managed Realignment should be developed** within the medium term, with recognition that there is **significant benefit in continuing to manage the frontage** – noting '*in all probability works will be needed to the north Barmouth frontage towards the end of Epoch 1*'
- The SMP2 expresses that whilst the **frontage is split over three areas**, the policies should be considered and '*progressed as one overall area*' – due to the coastal process influences between each policy area.

What does MR look like in an urban environment?

- SMP high-level technical analysis
- Significant impacts on social, cultural, and economic aspects of communities
- Question of local community and stakeholder engagement and understanding
- Affordability challenges:
 - Decommission existing defences (cannot walkaway safely)
 - Interfaces with adjacent 'hold the line' units (new defences)
 - Possible re-location of community (lack of suitable land or financial mechanism)
 - Impacts on nationally significant assets (railway)



Outcome of September 2024 discussion

- Agreed raise the scheme with the National Coastal Forum as a Major Change.
- Recognised logic of the approved design life approach (i.e. betterment of existing defences in the short-term). Consideration on opportunities to relax/reduce design life to avoid decommissioning assets with residual life in 2070s to be considered
- Implications on the current North Promenade FBC commission were yet to be fully determined. However, suggested YGC seek to define ‘what happens next’ beyond the short-term interventions. An iterative, proportional approach was advocated for which investigates the issues based on available information and identifies gaps for further exploration.

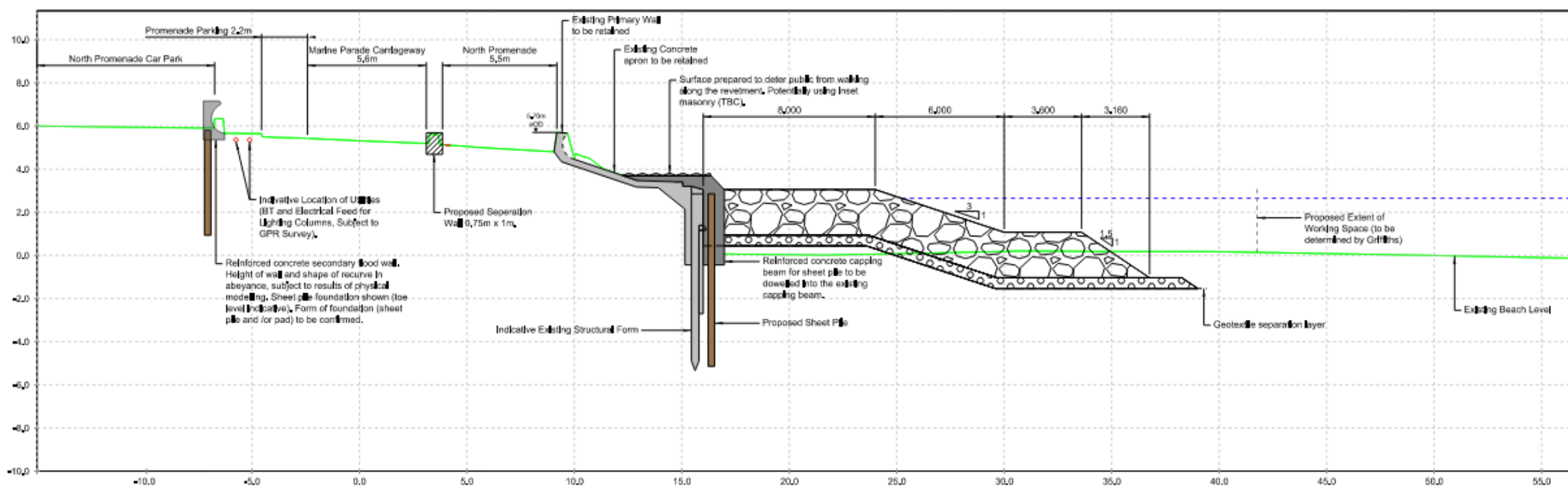
Emerging design update

Basis of Design Principles

Design standard	Coastal/Tidal dominated 2% annual exceedance probability event in 2075. Structure design life 100+ years in line with DMRB. No designed decommissioning. Surface water risk outside scope.
Beach	Beach frontage to be protected by rock revetment (avoiding costly beach recharge) Revetment to extend ~100m north to reduce outflanking (railway betterment avoid complex interface to north)
Primary wall	No significant condition issues identified. Revetment reduces loading. Existing wall to be retained at same level. (Makes most of existing asset and avoids visual impact from promenade)
Placemaking and access	Improvements to access, active travel routes, parking layout and amenity value.
Secondary wall	Ongoing physical modelling. Set back flood wall now varies (up to 1.7m with recurve). Alignments tested to reduce extents – however required to prevent outflanking.
Managed Realignment	Post-2075 concept yet to be developed. Frontage and hinterland flood cells found to have more interfaces. MR requires challenging decoupling and adaptation of structures beyond foreseeable scale. Propose monitor.

Representative cross-section

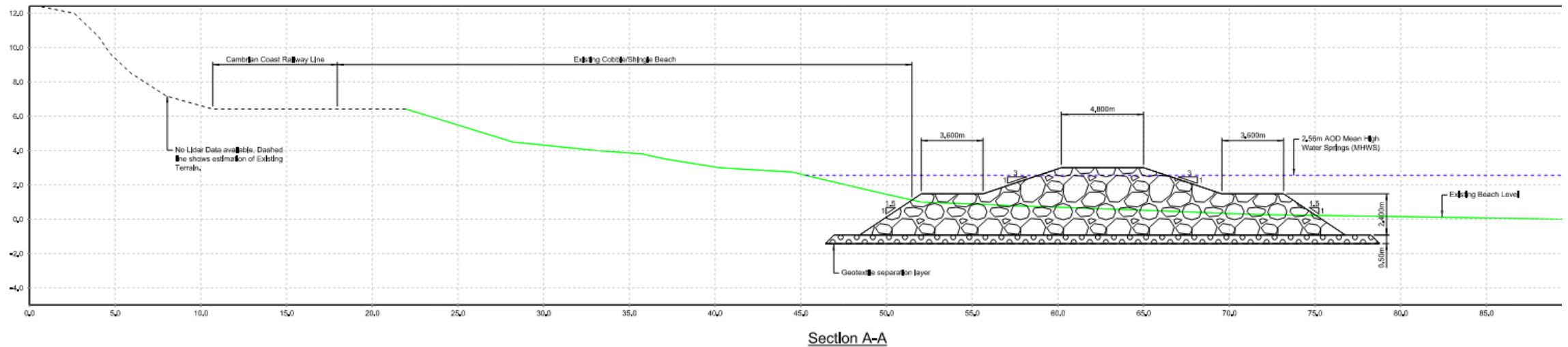
Main promenade



Section B-B

Representative cross-section

North of promenade



Discussion and conclusion



Summary

- OBC preferred option of betterment of existing defences with monitoring to epoch 2 approved by Welsh Government 2021.
- AGC supported by Arup appointed to deliver ‘betterment of existing defences’ FBC
- Significant design development and modelling of options carried out
- Post-2075 concept with separate solutions for north and populated south could be developed. Frontage more integrated than SMP/OBC considered. Propose monitoring.
- Progression of Major Change – agree next steps.
- Coastal Group agreement of proposed Consultation approach with key stakeholders.

ARUP

**Appendix E Welsh National Marine Plan
Compliance Note**